

EPA Region 5 Records Ctr.



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OPERATIONS & MAINTENANCE MANUAL INDUSTRIAL HIGHWAY SITE

Prepared for:

U.S. Environmental Protection Agency
Region V
Oil Recovery System
Industrial Highway Site
Gary, Indiana

EQ Project Number # 030228.0010

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SECTION 1

INTRODUCTION

Purpose

The Operations and Maintenance (O&M) Manual for the Oil Recovery System (ORS) equipment describes the procedures for operating and maintaining the components of the oil recovery system. The Recovery System includes the (6) Recovery Wells, Vaults, and the groundwater/oil recovery pumps and controls contained within the well vaults, the building including all equipment located inside, the discharge pipe and infiltration galleries, and overspill galleries.

Organization

This manual contains 8 sections. Section 1 is an Introduction. Section 2 provides an overview and description of the oil recovery system. Section 3 describes the startup, shutdown, and normal operating procedures for the system. Section 4 describes the System Control Panel, specifically designed for this site, housing the controls, switches, modem, and reset buttons for the site equipment. Section 5 describes the software program "Site Link" written with specific controls for the site, enabling local/remote monitoring and operation of the site equipment. Section 6 describes the six (6) 10" Recovery Wells, their construction, and the depths of the wells and the pumps and transducers used for recovery of groundwater and oil. Section 7 describes the subcontracted service of building and system surveillance through internal audible alarms, video surveillance, and phone service notifications. Section 8 describes the system maintenance schedule, detailing the scheduled routine maintenance needed to be performed on specific pieces of equipment, and how the maintenance should be performed. The appendices contain manufacturer's literature for each specific piece of equipment contained in the system.

SECTION 2

BACKGROUND

A significant quantity of (LNAPL) has been found to be discharging into the drainage ditch at the Chicago-Gary Airport for several years. The USEPA requested that their Response Engineering and Analytical Contract (REAC) division personnel develop a model of the site to:

- Evaluate groundwater flow conditions;
- Assess the interaction between groundwater flow and the LNAPL product plume movement;
- Evaluate the extent of the LNAPL on the shallow water table;
- Evaluate options to enhance product recovery and to hydraulically contain the product plume and eliminate discharge to the ditch.

REAC's written report to the USEPA, "**Lockheed Martin Technical Memorandum, Work Number 0-045**," dated February 6, 2002, suggested that there were (2) plumes on site migrating in the direction of the airport. The free product volume was estimated at 125,000 gallons, and it was anticipated that the groundwater recovery system would capture up to 20% of the volume of product before the residual would be captured in the subsurface, due to the low mobility of the material and its high viscosity.

REAC suggested the installation of a groundwater recovery system consisting of (6) Recovery Wells, with a 40 gpm cumulative pumping/re-injection rate of groundwater in to an onsite infiltration gallery, creating a groundwater-mounding scenario. This system would accomplish the necessary hydraulic draw down for the recovery of free product and reduce the migration of free product to the Chicago-Gary airport drainage ditch.

The USEPA began construction of the LNAPL Recovery System in October 2002, and completed and placed the system on line in March 2003. The system is currently operating and recovering free product.

SECTION 3

SYSTEM DESCRIPTION

Groundwater and oil is recovered/pumped through six (6), 4" Stainless steel groundwater pumps in the Recovery Wells. Each Recovery Well is approximately 35' deep with, 10" SCH 80 PVC, and a 0.10 slot screen. The total fluid is pumped from each pump at an estimated flow rate of approximately 8-10 gpm, back to the recovery system building into a 100 gpm stainless steel oil/water separator.

The oil/water enters the separator through a non-clog diffuser, and has time to settle and begin separation in the separation chamber, allowing suspended solids to settle in the sludge baffle, and allowing the oil to begin passing through the filter media (Coalescent Plates) to the top of the packing in the separation chamber. The oil may then be skimmed manually off the top of the chamber through a rotating 4" SCH 80 PVC pipe skimmer to the oil storage compartment on the separator.

Any solids that fall out in the separation chamber and settle in the sludge baffle are pumped out of the separator through two (2) 50 micron sock filter canisters. The sludge transfer pump is a "Moyno 500 series" pump that can be controlled either manually or automatically through the Product Level Control (PLC) control panel. The pump transfers water and solids through the canisters that can be operated singly or in a series, with the solids being captured in the sock filters and the effluent water being pumped back into the separation chamber of the oil/water separator.

The effluent then passes on to the clean water chamber through an underflow and overflow weir. The clean water chamber holds approximately 300 gallons of effluent that collects before being pumped to the 1,000-gallon poly-holding tank. The effluent is pumped to the 1000 gal. poly storage tank through a 2" line to a "Gould" centrifugal pump, which pumps it through a 2" PVC line to the 1,000 gallon poly storage tank.

Both the oil storage and clean water chambers are monitored to the control panel by multi-level switches that control the operation of the transfer pumps. The controls are set to turn the pumps on/off and shut the system down when the top multi-level switch is in the up position, and the hi control level is contacted. When each chamber has the low switch and hi switch in the up position, the product and effluent transfer pump will turn on and pump the chamber empty. Each multi level switch in the separator, oil storage chamber, 1,000 gal. poly tank, and the 5,000 gal. storage tank is controlled and operates the other components of the system through the system

control panel. The rods have three (3) switches on them that electronically signal whether the tank is in the low, hi, or hi-shutdown position. These switches relay to the control panel whether to turn the pumps on or off through the control logic for the system.

The oil storage compartment on the separator is where the oil is skimmed to through the rotating weir. The compartment is capable of holding approximately 116 gallons of oil that is stored until the contact level switches show the tank to be in the full (hi) position. The oil is then pumped through a 1" line to a "Gould" centrifugal pump, which transfers the oil through an electronic flowmeter out to the vertical 5,000 gallon Steel Storage Tank outside of the building.

The effluent stored in the 1000 gallon Poly Storage Tank is pumped out to the 1st "Infiltration Gallery" onsite by the 10k "Price" close-coupled centrifugal pump. The control switches in the 1,000 gal. Poly tank relay to the control panel to turn the pump on/off, the effluent is then pumped through a 2" SCH 80 PVC line through an electronic "Signet Vortex" flow meter. The flow meter calculates the GPM of the flow of effluent through the pipe, and also totals the daily amount of effluent being pumped onsite to the Infiltration gallery. The flow meter also records the total amount of effluent being pumped through the system. The effluent then passes through the 2" SCH 80 PVC pipe to a 4" SCH 80 PVC pipe inside the system building, the 4" line has a K-2 "Ashcroft" pressure transducer that records the amount of backpressure that is being generated during pumping of the effluent to the infiltration gallery.

The effluent travels approximately 250' through the 4" SCH 80 PVC pipe to an Inground stone Infiltration Gallery. The effluent passes through the pipe to an open end discharge point at grade level, the water then flows or distributes itself throughout the 5' deep, 20' wide x 100' long stone gallery, the effluent either infiltrating back into the ground through the bottom of the gallery, or collecting and flowing on to a 1st Overspill Gallery through a 6" SCH 40 PVC pipe. The 1st Overspill Gallery is located onsite approximately 100' south of the infiltration Gallery. The Overspill Gallery consists of a depression onsite that was created on the western edge of the property, between the acids lagoon cap onsite and the abandoned railroad spur. The Overspill Gallery is a depression that is not lined with stone, allowing the effluent to pass through the soil into the ground, or collect and pass through a 16" corrugated pipe to a 2nd Overspill Gallery. The 2nd Overspill Gallery is located on the western edge of the site, between the abandoned railroad spur and the wetlands between the site and the Cline Ave. frontage road.

The 2nd Overspill Gallery is a low lying area with a stone bottom, that was created by the excavation of previous offsite acid lagoons, the contaminated soil being excavated and deposited in the onsite containment areas. The 2nd Overspill Gallery is approximately 4' deep, by 30' wide and 150' long. The effluent ponds in the galleries, either migrating through the top layer of soil into the ground, or by ponding and flowing gravitationally through the pipes to the next holding

gallery. The USEPA determined through the site "Groundwater Model" that the effluent being pumped behind the present oil plume onsite would create a mounding effect, and help push the oil back to the recovery wells.

SECTION 4

SYSTEM CONTROL PANEL

The Recovery System at the Industrial Highway site is fully automated through the 240 volt, single-phase site control panel and can be maintained and monitored from a remote location through the software system created for the operation and monitoring of the system called "Site Link". The control panel has three (3) sets of relay switches that control the pumps making up the site equipment. Each relay switch can be activated automatically through multi-level switches in the tanks, or pressure transducers in the 10" Recovery Wells.

The control panel is an enclosed steel panel with a lockable front door panel the inside front panel consists of three (3) rows of switches that control the components of the system. Each switch can turn a pump on manually, or can be set to run the pump automatically. The multi level switch in the tanks and separator will send a relay signal back to the memory in the program, telling the pump to turn on/off, depending on the quantity of oil/water in the vessel. At the Recovery Wells, a pressure transducer in the bottom of the wells can be set automatically to read the amount of head pressure in the well depending on the column of water above the pump and turn the water table depression pumps on or off depending on the quantity of water in the column.

** The top set of relay switches on the front of the panel formerly controlled the six (6) "Geotech" oil skimmer pumps, when the onsite process for recovering oil called to create a water table depression for skimming of oil that entered the recovery well. Those (6) pumps have been removed, and EQM has gone to "Total Fluid Recovery". The second row of switches controls the (6) Groundwater "Water Table Depression Pumps" in Recovery Wells #1-6. The (6) pumps in those wells are controlled automatically by pressure transmitters installed in the wells. The transmitters work electronically, and are set to operate through the "Site Link" program. The transmitters can be set to turn the pumps on and off when the water in the column is at any depth.

Typically, the pumps are set to operate at a low depth, thereby enhancing the water table draw down, and enabling the oil to enter the well more effectively. The pumps can also be turned on and ran manually, the user must be aware that they should monitor the quantity of water in the well in order to prevent a possibility of burning up the motor in the pump.

The third row of switches controls the (4) centrifugal transfer pumps inside the Recovery System building, (the Oil/Water Separator pump, the Product pump, the 10k Effluent pump, and the sludge pump). The first three pumps are controlled automatically through multi-level switches in the tanks. These switches are controlled through relays in the panel that signal the pump to turn on

when the middle level of hi is met, and to turn off when the bottom level of empty is met. There is also a hi-hi level that signals to the panel that some component of the system has gone down, and the tank is going to flood. This signal will shut down the system, and EQ will be notified of a system shutdown through the alarm monitoring surveillance of the system.

The fourth and final pump is the "Sludge " pump. This pump can be controlled automatically through the "Site Link" system, but is usually controlled manually by the maintenance technician on site. The pump can be turned on in manual mode, and the pressure transducer in the line before the 5 micron sock filter will read the pressure in the vessel, any pressure building over 20 psi should signal the technician of the pump being shutdown.

Below the third row of switches on the front of the control panel is a manual reset button that needs to be reset any time the system is shut down, or if a component goes down, or if a pump is put in manual mode, then turned on in automatic mode.

There is also a large button that controls the local/remote hookup to the "Site Link" monitoring system. When calling up site line from onsite (local hookup), the button should be pulled out, this will enable the onsite user to hook up to monitor the system through the onsite computer. When disconnecting, the button should be pushed in, this will enable someone to call up the site from a remote location through the onsite modem in the control panel. There is also a fail safe incorporated in the front panel, when you close the front door; a device closes the button automatically.

At the bottom of the front control panel, is an auxiliary phone jack outlet, enabling anyone on site to hook up a phone for a direct line offsite for emergencies. Finally, at the top right hand side of the control panel, is a breaker switch that can turn the system on/off manually while working on the internal parts of the control panel.

It is recommended that both the front switch and the main breaker switch on the outside 200-amp panel be turned off when any internal work is going on inside the control panel.

SECTION 5

SITE LINK, LOCAL/REMOTE SYSTEM MONITORING

The "Site Link" software program was developed by the manufacturers of the site control panel, Product Level Control, in order for sites to be able to monitor and control their systems onsite or from remote locations. The program is modified with site-specific controls for individual sites and their components.

The program CD can be installed on the computer of the personnel monitoring the site, allowing them to hook up and monitor the system through the phone line connection into the computer. The connection into the control panel's modem allows the user to call up (2) different screens/windows, the option is to select the window showing the remote/local connection, or to go to the data storage section of the program.

The window showing the site displays the internal layout of the system equipment and the piping of the equipment. Once the program is connected, the user has the option of viewing the equipment layout window, or going to other windows showing:

1. Equipment Stats
2. Startup/Shutdown of Equipment
3. Equipment Set/Points
4. Recovery Wells

The window option allows the user to monitor the system, turn equipment on/off, troubleshoot problems with the system, or view runtimes and cycles of equipment over a 24-hour period.

The second window option available to the user when the system is called is the "Site Data" window. The user can call up the system and download data showing the daily log of runtime/cycle of all the equipment, or the ongoing total log time and cycles of the system equipment since the system was put online. The data is stored in the internal memory of the program, and can be manually downloaded by the user following a series of prompts/commands. Once the internal memory downloads the data, the user can open the spreadsheet, an "Excel" generated spreadsheet by enabling macros. The spreadsheet also shows the amount of oil and water pumped daily and overall through the system through the two (2) electronic "GF SIGNET Vortex flowmeters."

The data displayed in the spreadsheet can be saved on the c; drive or printed for submittal to different agencies monitoring the removal activity.

SECTION 6

RECOVERY WELLS

The recovery system consists of six (6) Recovery Wells that border the eastern edge of the site property. The wells begin approximately 100' south of the Recovery system building, and are installed every 100' to the southern end of the property. The wells create an oil recovery barrier wall along the east side of the property, and were installed approximately 100' apart as suggested in the "USEPA Technical Memorandum, Groundwater Model Approach." The model suggests that the location of the wells will create the necessary draw down to hydraulically control the plumes, and prevent further LNAPL migration towards the ditch at the Chicago-Gary airport. The pumping rate of 40 gpm cumulatively will enhance free product recovery at the wells, and with the reinjection of the groundwater at the Infiltration Gallery, create a closed loop barrier system along the east side of the property.

The wells are 10" SCH 80 PVC, .010 slot screen, and are installed to depths varying from 25' to 35' deep. Each well has a 5' sump at the bottom of the well, and has well screen from 5' below grade to the sump. Each well has approximately 24" of PVC pipe extruding above grade level into a lockable steel well vault. The steel well vaults have two doors on the top that can be opened and locked open for access to the components of the wells. The inside walls of the vaults have been lined with insulation board, thereby reducing the amount of freezing that can go on inside the well vault during down time in winter months.

On the inside wall of each well vault, is a step down transformer box that contains the electronic cable hookup and aneroid bellow for each well's depth transducer. The transducer cable leaves the step-down box, and is attached to a 1" SCH 80 PVC pipe that is suspended on the inside wall of the 10" pipe, and is suspended to the bottom of each well. The depth transducer reads the amount of head pressure in each well, and controls the groundwater pumps through the settings in the "Site Link Program". Each well has a "Grundfos" Redi-Flo4, Stainless Steel Submersible pump that was built for environmental applications. The pump is a 4", 8-stage motor pump that is wired directly back from the well vault to the control panel. The pumps can be run automatically through the Site-Link program, or can be turned on to run manually from the control panel. ****(It is recommended that if the pumps are run manually, they be closely monitored to prevent burning the pump motor out if the well has no water.)** The groundwater pumps have the capability of pumping up to 16 gpm, and in this application, are used to pump total fluids back to the recovery building. The effluent line leading from the pump is a 1" heavy gauge petroleum based hose, that is plumbed into a 1" SCH 80 PVC line in the vault. The effluent passes through

the hose into the line that consists of a 1" gate valve, into a 1" SCH 40 PVC spring check valve, then on to a main line that enters through the bottom of the recovery building in a 4" SCH 80 PVC line into the separator. The effluent hose and pipe from the top of the 10" PVC pipe to where the line enters the ground; it is wrapped in a heat trace tape, and with outer fiberglass insulation to prevent freezing at the well heads if the system stops pumping. The heat trace line is plugged in to a 110 GFI outlet in the well vault. In each well vault there are also spare sets of lines that were installed during the construction of the system. There is additional 1" SCH 80 PVC lines that the effluent from each well can be plumbed to if one of the lines is broken or goes down over time. The additional well stub-up in each well vault can be utilized by switching over the effluent hose to the spare line. Each line is equipped with 1" camlok fittings to accommodate the hose fitting. Next to these spare lines in each well vault is also a 1" SCH 80 PVC line that can be plumbed to an air line for purging of the lines of any biofouling or scale buildup that could inhibit effluent from flowing through the line.

A portable air compressor can be attached to the line with a quick disconnect, and a low flow air purge can be blown through the line at a 5-10 psi flow to purge the line without damage to any of the fittings due to excessive air pressure. Installed on the top of each 10" PVC pipe in each well vault is also a steel winch assembly that is connected to each groundwater pump, the gears on the winch assembly are set on a low gear, enabling easy removal for O&M on each pump by winching the pump up to grade level.

SECTION 7

ALARM COMPANY MONITORING

The site is monitored 24 hrs. a day, 7 days a week, by an outside alarm company, "Hyre Technologies", that employs the services of "Emergency 24" for notification and monitoring of the site. Personnel at Emergency 24 monitor any alarms that they receive through the onsite interface equipment, and make the notifications to authorized personnel assigned to the site, and to the proper authorities required for emergencies.

The site is monitored for the following activities:

- Entry/Exit
- Fire
- System Down
- High-Temperature / Low Temperature

These classifications of alarms are broken down into the following zone codes for notification purposes to the client: *Zone 1 System Down, *Zone 2 Service Door, *Zone 3 Overhead Door, *Zone 4 Motion Alarm, *Zone 5 Fire Alarm, *Zone 9 Temperature Alarm, and *Zone 10 Valve Tamper Alarm.

7.1 Intrusion Alarms

The building is monitored against intrusion by entry alarm contacts on the front service door, the overhead equipment door, and with interior motion alarms. If unauthorized entry to the building should occur, an extremely loud audible alarm goes off within 45 seconds unless a designated security code is entered onto the keypad to disarm the alarm.

Upon engagement of the alarm, the designated police authority assigned to the site will be immediately contacted by "Emergency 24" personnel, and the personnel from the company assigned to the emergency notification list will be notified. Disarming of the audible alarm will be done through the keypad for the system.

7.2 Remote Video Surveillance

The interior of the building is also monitored through a motion alarm and remote video Surveillance equipment. The "Oz Vision" digital video monitors/cameras are located in the corners near the ceiling of the room, and are set up to allow the viewer to view the room for

intrusion. The Oz Vision is a CD software program that can be installed on the computers of personnel assigned to the site, and allows the user to call the site through a phone land line, or through a wireless connection, (which this system has) monitors the building through cameras hooked to the sites phone line. The program enables the user to view the inside of the building, videotape the intruder inside the building and digitally record on the computers hard drive, including date and time for possible legal proceedings, and print images on a standard printer.

7.3 Fire Alarm Monitoring

The building is monitored for three separate parameters that are temperature related, and all are monitored by the "Winland Temp Alert Sensor" that is also wired in to the security keypad inside the building. The sensor for our system is set for:

130>degreesEmergency 24 to call the Gary Fire Dept., then notify site personnel

110>degreesEmergency 24 to notify site personnel

30<degreesEmergency 24 to notify site personnel

The building is not equipped with fire suppression equipment or sprinkler systems. The hi temperature would alert site personnel that something inside the building is causing an extreme rise in temperature that could be an alert for an upcoming fire. A low temperature would indicate that the power is out, or that the electric heaters inside the building are inoperative, and unless some secondary form of heat could be introduced, there could be a possibility of lines freezing and rupturing.

7.4 Valve Tamper Alarm

The 5000 gallon Steel Storage Tank outside the system building has a valve tamper alarm on the 4" Butterfly flange and valve at the bottom of the tank. The valve presently is chained and padlocked, and the valve tamper alarm is engaged. If the tank becomes full, and it needs to be pumped out, assigned site personnel need to call Emergency 24, and give them the password before opening the valve. If unauthorized personnel attempt to open or tamper with the valve without Emergency 24 being notified, a call will be made after the alarm is recognized, and site personnel will be notified that there is a possibility that someone is trying to vandalize the tank, possibly creating a massive oil spill outside the building.

7.5 System Down Alarm

The Recovery system is monitored at certain points to allow for notification by Emergency 24 personnel when a "System Down" alarm occurs. The system down alarm would occur as a failsafe when a component of the system would shut down within the building, resulting in the entire system shutting down rather than certain components continuing to run and possibly flood the building. The components that would signal a system down alarm are the multi-level switches being contacted as hi-hi in the 1000 gal. poly effluent tank, the oil-water separator, the product storage side of the oil-water separator, and the floor sump. A hi-hi alarm in the floor sump would indicate a broken line inside the building, a hi-hi alarm on any of the other three components would indicate that one of the three associated transfer pumps were not operating properly, and that the other components should each individually shut down to reduce the possibility of flooding of the system and the building. Emergency 24 will notify site personnel when a system down alarm will occur, (they will not be able to identify which component of the system has gone down.)

SECTION 8

SYSTEM MAINTENANCE SCHEDULE

8.1 Daily Offsite Monitoring

Personnel assigned to the site for O&M, should have the program "Site-Link" installed on their computers, and have a dial-up capability on their computers. The site should be called up on the computer daily to view the operation of the system, and to monitor the components of the system. The "Data" portion of Site-Link should also be viewed to account for the daily totals of what is being pumped through the system, and to monitor the operations/cycles of the well pumps and the transfer pumps.

8.2 Weekly Site Maintenance

Weekly operations and maintenance onsite should include:

- a.) Connection to Site-Link through the Local Connection on the panel to monitor the system while onsite, adjusting flow rates, or turning equipment on/off manually onsite to work on equipment.
- b.) Manually adjusting the weir on the Oil/Water Separator to skim oil for pumping to the 5000 Gal. Oil Storage Tank.
- c.) Cleaning of the hi-lo sensors/multi-level switches in the oil/water separator and the 1000 gal. Effluent Storage Tank.
- d.) Monitoring the gpm of the 10k Effluent pump and the back pressure building in the line to assure that excessive back pressure does not burn the pump up. If the gpm falls below 60 gpm, or if the pressure builds above 15 psi, fouling of the line is occurring, and the maintenance of the line, including jetting of the line, needs to be scheduled.

8.3 Bi-Weekly Site Maintenance

Bi-weekly maintenance should include the weekly activities and also:

- a.) Manually turn on the Sludge Transfer pump and pump any sludge accumulating in the separation chamber of the separator through the (2) 25 micron sock filters.
- b.) Monitor the pressure building in the sock filters through Site-Link, if the pressure builds to above 25 psi, replace the sock filters with new ones.

- c.) Unlock all five Recovery Well Vaults, and visually inspect the inside of the well vault. Inspection should include monitoring of the heat trace line during winter months to verify that they are working, and inspect each well vault for any possible leaks in the piping that could cause the well vault to fill with oil/water.
- d.) Visually inspect the Infiltration Gallery to ensure that the effluent is flowing out of the pipe onto the ground without any buildup or breaks in the line. The inspection should also be done to verify that no visible oil is floating on the groundwater being discharged and flowing to the Overspill Galleries. If any visible oil is seen, oil absorbant boom can be deployed at the discharge point.

8.4 Monthly Maintenance Schedule

Monthly maintenance onsite should include all the above activities covered daily, weekly, bi-weekly, and also:

- a) Remove effluent flowmeter from line, clean flowmeter of iron scale, and put flowmeter back on line.
- b) Inspect the monitoring system and lock on the 5,000 gallon storage tank.
- c) Inspect the fence around the perimeter of the site for openings.
- d) Inspect the condition of the transfer pumps and lines inside the building.

8.5 Semi-Annual Maintenance Schedule

Semi-annual maintenance on the system will include the activities associated with the other maintenance schedules, and will also require the system be turned off. The semi-annual maintenance will also include:

Mobilization of a 5,000 gal. vacuum tanker for pumping of liquid stored in the 5,000 gallon Oil Storage Tank

- a) Pumping and cleaning of the components inside the building.
- b) Pump the remaining effluent in the 1,000 gallon poly tank out to the infiltration gallery. Utilizing a 3,000 psi steam cleaner and degreaser, steam clean/power wash the inside of the 1,000 gallon poly tank, remove the (3) multi-level switches, clean with degreaser, remove iron buildup, and reinstall switches.
- c) Pump remaining oil from product side of separator into tanker, clean inside of tank and switches with degreaser and 3,000 psi steam cleaner.
- d) Pump any remaining effluent in oil-water separator through system. The remaining 1-2" of oil left in the separator should be pumped out to the tanker for disposal.

The coalescent packing should be cleaned in the separator with degreaser and the 3,000 psi steam cleaner. All cleaning liquids, water and oil, should be pumped out to the vacuum tanker for disposal with the oil.

- e) The 4" stainless steel groundwater pumps should be removed from each individual well vault, along with the 1" effluent hose leading from the pump up to the 1" discharge line leading to the building. The pump should be removed from the well, and the intake screen should be cleaned utilizing steam and the degreaser. The pump at that time can be tested to see what type of gpm it is presently pumping. 10-15 gpm is needed for the site. The 1" discharge line should have the hose inspected for deterioration, or to have any fittings replaced on the pump or hose due to deterioration. The interior of the hose should be cleaned of any iron buildup, utilizing low air pressure from a portable air compressor, or by pumping and jetting the inside of the hose with the steam cleaner.

Any discharge from the cleaning of the pumps and hose should be contained in open-top 55 gallon drums, prior to pumping to the vacuum tanker.

8.6 Annual Maintenance Schedule

The annual maintenance should include the above activities listed in the other schedules and:

- a) Mobilization of a subcontractor with industrial maintenance capabilities to jet/clean the 4" SCH 80 PVC effluent line leading from the building to the Infiltration Gallery. A 2,000 gallon truck with a 3/4" hose, approximately 250' in length, can be run from the discharge point at the infiltration gallery, back to the building. The jetting of the line will remove scaling and iron buildup, and should increase the gpm of the effluent transfer pump. It will also decrease any back pressure building in the lines. The cost of jetting the line will be minimal, the time to jet the line is under 4 hrs.
- b) Mobilization of a well drilling unit for cleaning/surge blocking of the 10" Recovery Wells. The system needs to be shut down during this maintenance activity. Remove the pump and hose from the well, and using a cable drill rig, clean the inside screen with a wire brush to remove any debris/bacteria clogging of the well screen. Add a low ph acidic cleaning agent to the well, that is calculated based on the depth of the well. Surge block the well with the agent in the well, then reinstall the pump and pump the cleaning agent through the system until the water in the well becomes clear. The pump can be placed in a small 20-30 gallon tank with the cleaning agent to remove any bacteria from the pump and screen before re-

installation. The cleaning agent can also be run through the line from the well heads to the Recovery System building, thereby assuring that the lines leading in to the building will still not be carrying any residual bacteria. Once the Recovery Well, the pump, the hose, and the lines leading to the system have been purged and cleaned, the components of the well can be re-installed and the well can be placed on line. (The Recovery Wells and the lines leading in to the building should have the yearly maintenance done on them before the maintenance on the components inside the building are done).



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Start Up/Service

Product Level Control, Inc. (PLC) inspects and tests all equipment before shipping to assure all performance requirements are met. It is the responsibility of the BUYER to make certain the equipment is installed properly and completely. The BUYER can request assistance from Product Level Control, Inc. for start-up services or operation and maintenance at normal service rates. Current Service Rates are listed below.

SERVICE/LABOR RATES

	Service/Travel First 8 hours	Service/Travel Overtime
Monday through Friday	Technician \$85/hr.	Technician \$125/hr
Monday through Friday	Engineer \$100/hr.	Engineer \$150/hr

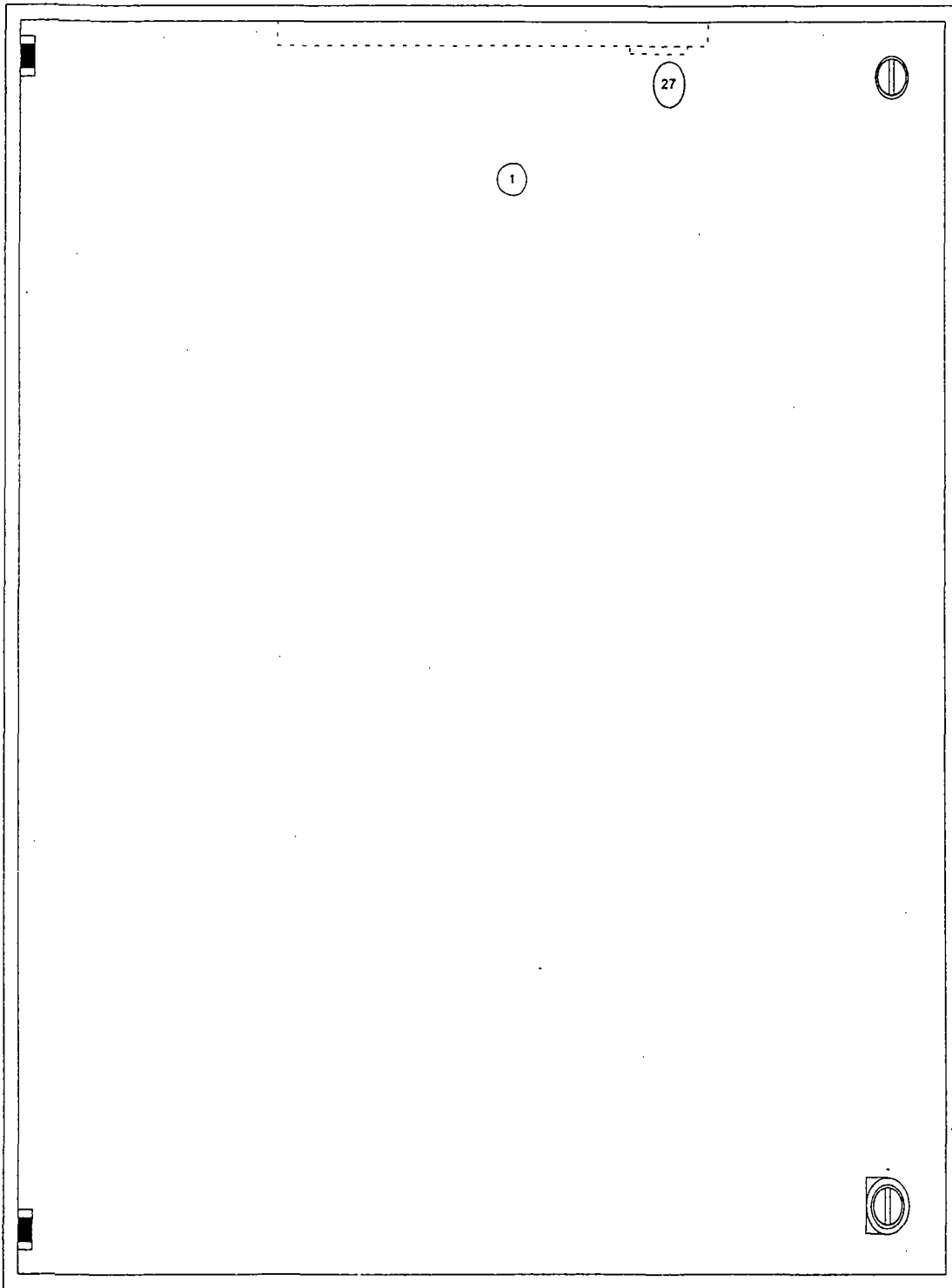
Product Level Control Inc. serviceman will present a daily log of time worked/traveled for signature by the BUYER'S representative.

Travel expenses are in addition to the Service/Labor rates.

Time is defined as door to door.

If the BUYER requests serviceman to stay over weekend/holiday to be available on the following workday the BUYER will be billed 8 hours per day at the service rate for each weekend/holiday plus expenses.

36"



50"

22

115 VOLT 12W
GFI RECEPTAL



EQM
GARY AIRPORT
INDIANA

02-072 production REV B.vsd

16 16

NONE

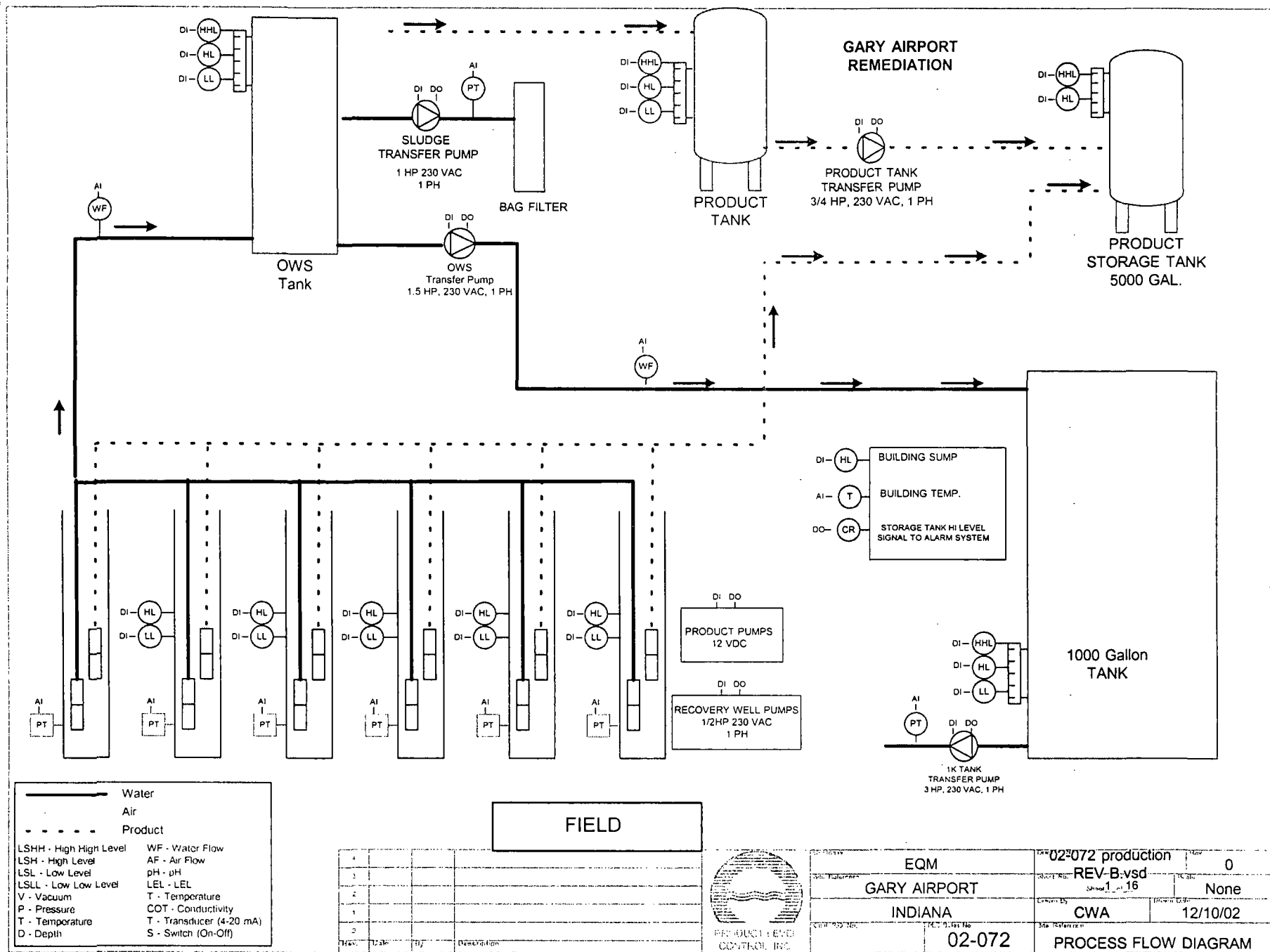
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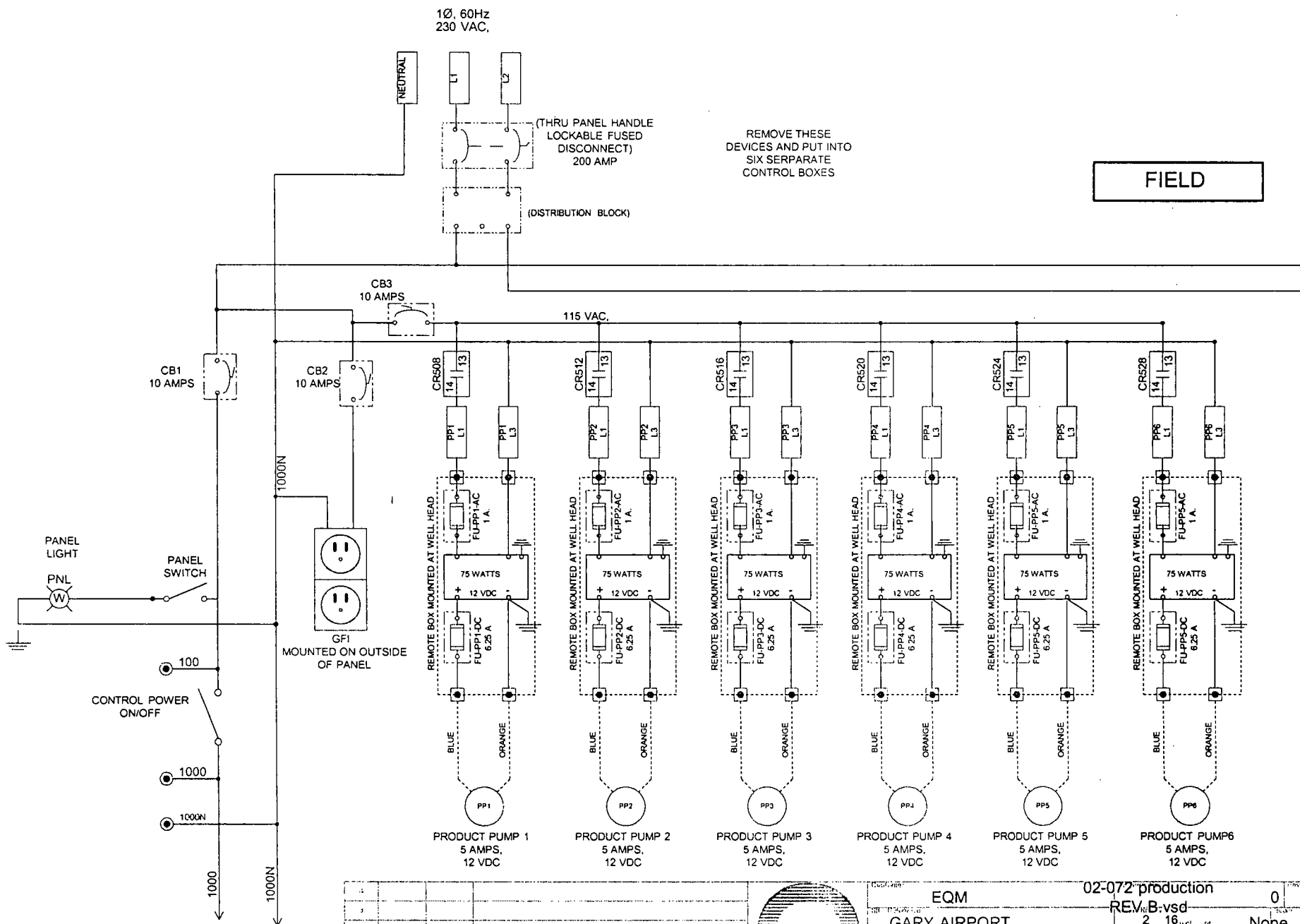
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02-072

Enclosure

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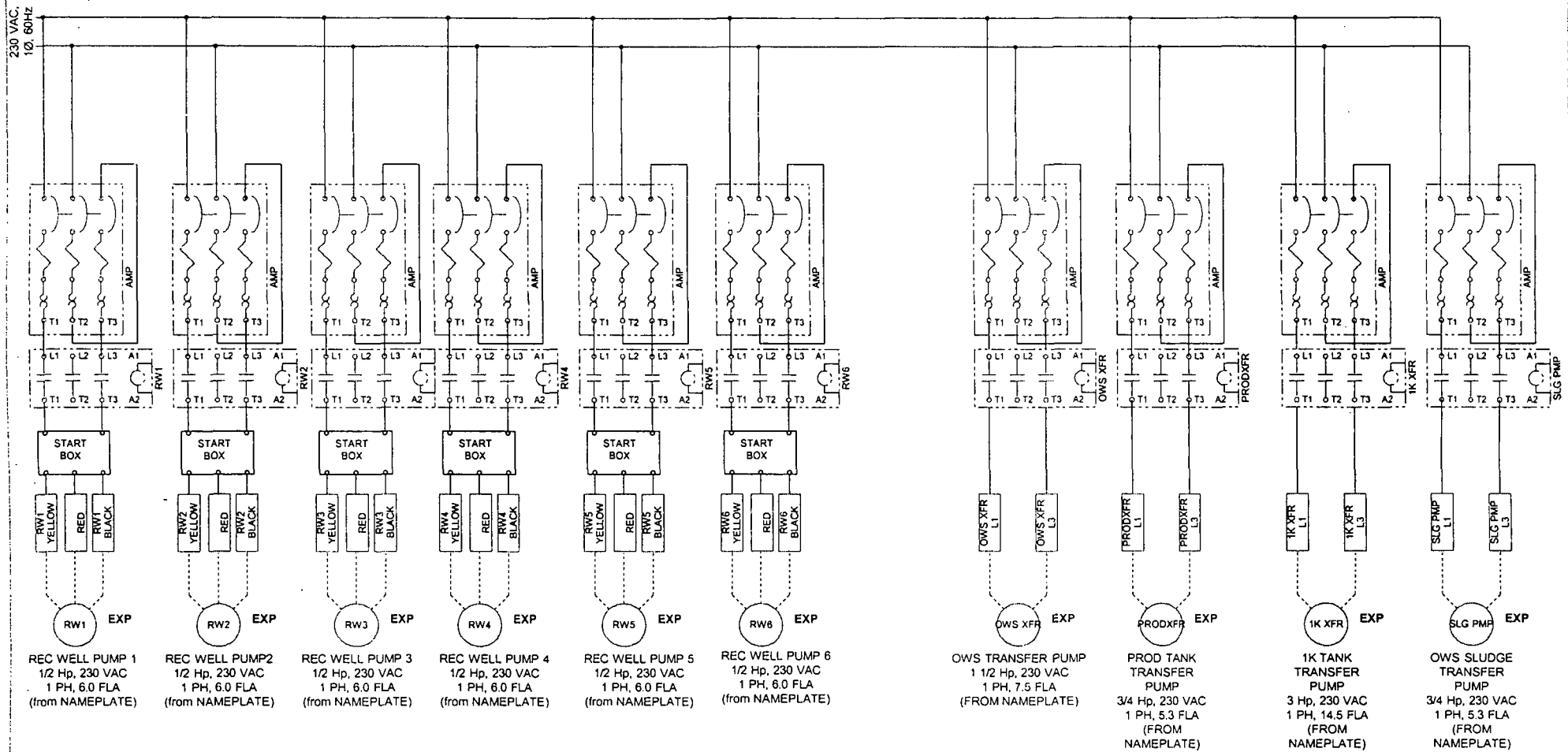


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PRODUCT & CONTROL

EQM	02-072 production	0
GARY AIRPORT	REV B: vsd	2 16
INDIANA	CWA	12/10/02
02-072	Motor Starters & Power	



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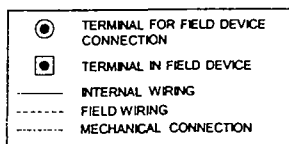


PRODUCT CONTROL

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GARY AIRPORT	REV B vsd	3 16
INDIANA	CWA	12/10/02
02-072	Motor Starters & Power	



Local/Remote
Computer/Phone Switch
(104, 132 - 144)



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200
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276

SLOT 2
D2-16ND3-2

FIELD

CA ⊕

2000 24 + < (1320)

INPUTS

0 ⊕

2080 8 1 1

2081

2082

2 1 7

OWS Tank
HIGH HIGH LEVEL

1 ⊕

2120 5 1 4

2121

OWS Tank
HIGH LEVEL

2 ⊕

2160 8 2 1

2161

OWS Tank
LOW LEVEL

3 ⊕

2200 5 2 4

2201

2202

3 2

PRODUCT TANK
HIGH HIGH LEVEL

4 ⊕

2240 8 3 1

2241

PRODUCT TANK
HIGH LEVEL

5 ⊕

2280 5 3 4

2281

PRODUCT TANK
LOW LEVEL

6 ⊕

2320 8 4 1

2321

2322

2 4

PRODUCT STORAGE
HIGH HIGH LEVEL

7 ⊕

2360 5 4 4

2361

PRODUCT STORAGE
HIGH LEVEL

NC ⊕

CB ⊕

2000 24 + < (1320)

0 ⊕

2480 8 5 1

2481

2482

2 5

1K GALLON Tank
HIGH HIGH LEVEL

1 ⊕

2520 5 5 4

2521

1K GALLON Tank
HIGH LEVEL

2 ⊕

2560 8 6 1

2561

1K GALLON Tank
LOW LEVEL

3 ⊕

2600 5 6 4

2601

2602

3 6

BUILDING SUMP
HIGH LEVEL

4 ⊕

2640 8 7 1

2641

2642

2 7

PRODUCT PUMP 1
HIGH LEVEL

5 ⊕

2680 5 7 4

2681

PRODUCT PUMP 1
LOW LEVEL

6 ⊕

2720 8 8 1

2721

2722

2 8

PRODUCT PUMP 2
HIGH LEVEL

7 ⊕

2760 5 8 4

2761

PRODUCT PUMP 2
LOW LEVEL

DC INPUT MODULE
16 POINTS

INTRINSIC SAFETY BARRIERS

TERMINAL
NUMBER

BARRIER
NUMBER

TERMINAL
NUMBER

8 1 1



TERMINAL FOR FIELD DEVICE
CONNECTION



TERMINAL IN FIELD DEVICE



INTERNAL WIRING



FIELD WIRING



MECHANICAL CONNECTION

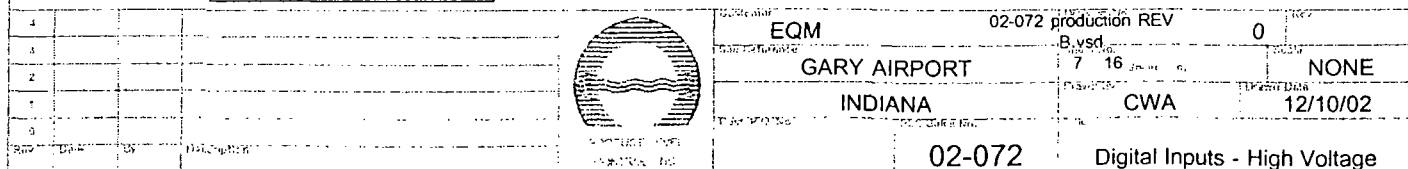
ALL CONTROL WIRING
TO BE 16 GAUGE WIRE

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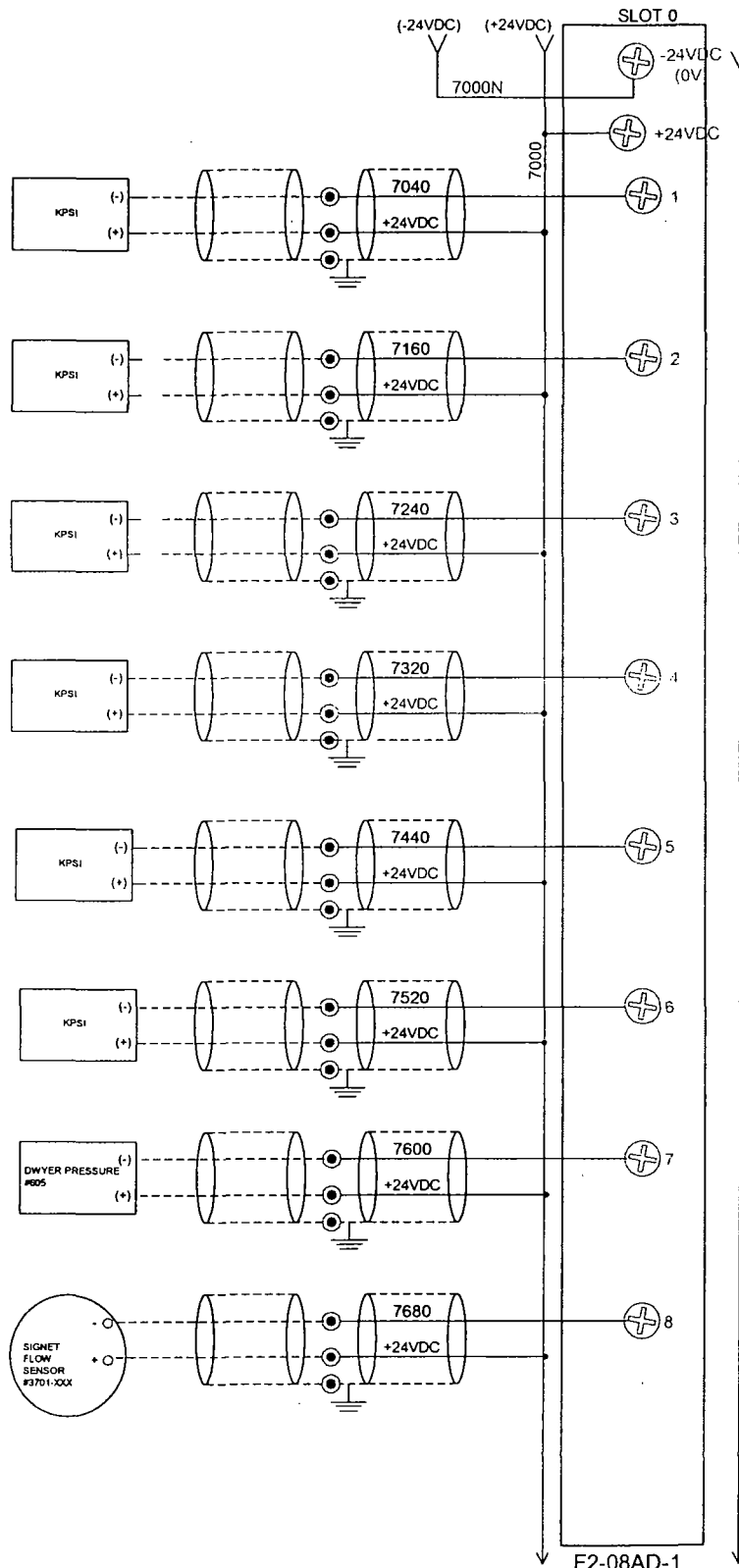
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Site	GARY AIRPORT	REV-B.vsd	NONE
City	INDIANA	Sheet 5 of 16	12/10/02
Contract	02-072	CWA	DIGITAL INPUTS LOW VOLTAGE

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FIELD

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(END)

●	TERMINAL FOR FIELD DEVICE CONNECTION
■	TERMINAL IN FIELD DEVICE
---	INTERNAL WIRING
---	FIELD WIRING
---	MECHANICAL CONNECTION



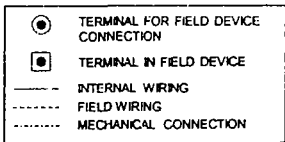
02-072 production	00
EQM 1 16	REV: B.vsd
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INDIANA	CWA 12/10/02
02-072	ANALOG INPUTS

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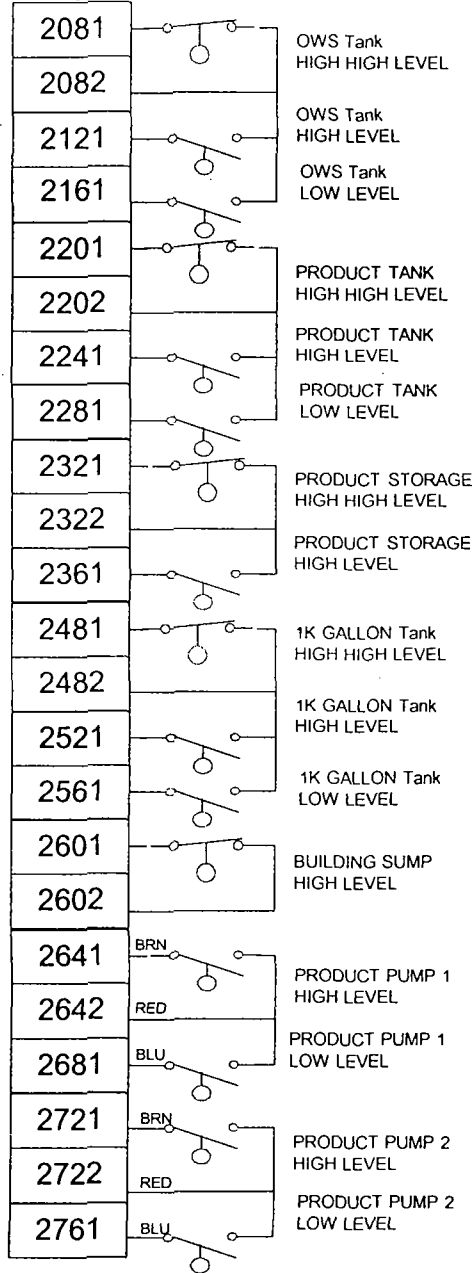


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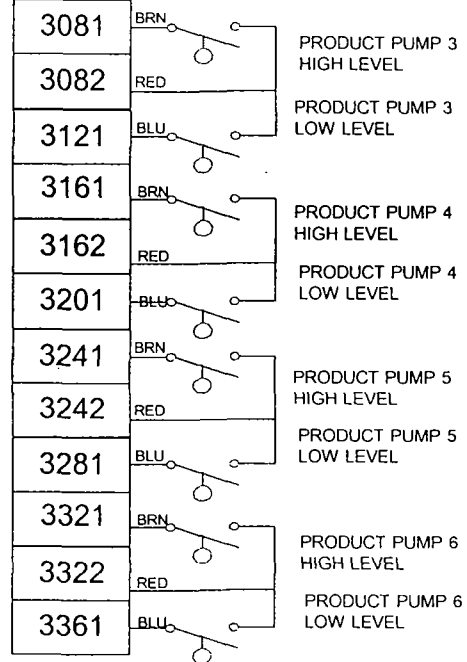


CONNECTION DIAGRAM FOR FIELD DEVICES

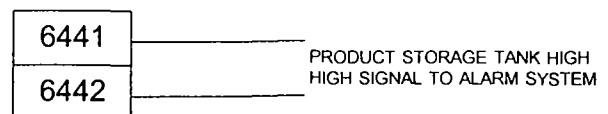
INTRINSIC INPUTS



INTRINSIC INPUTS



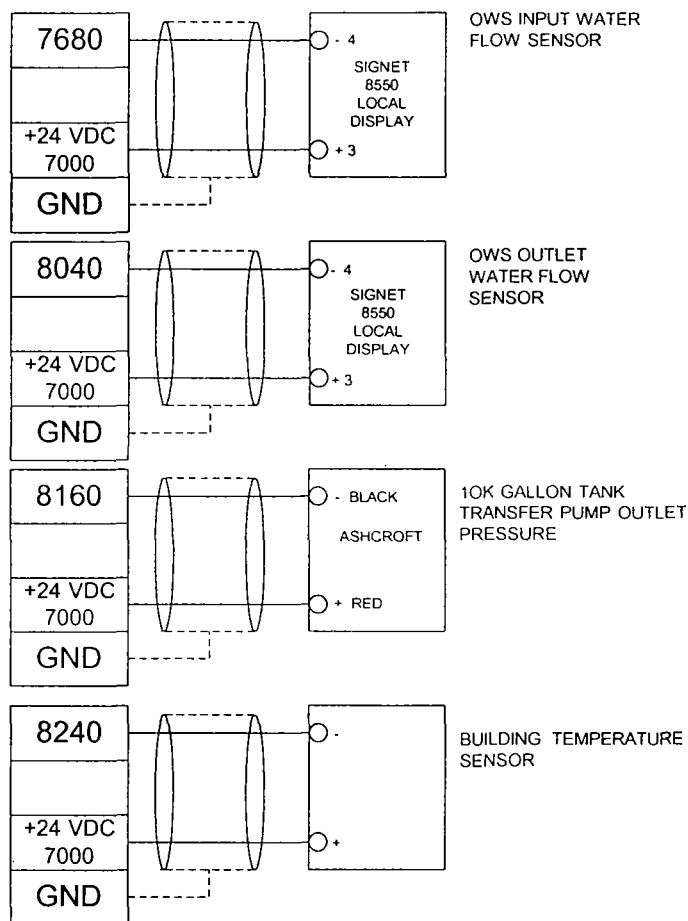
non INTRINSIC CONNECTIONS



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DEVICES

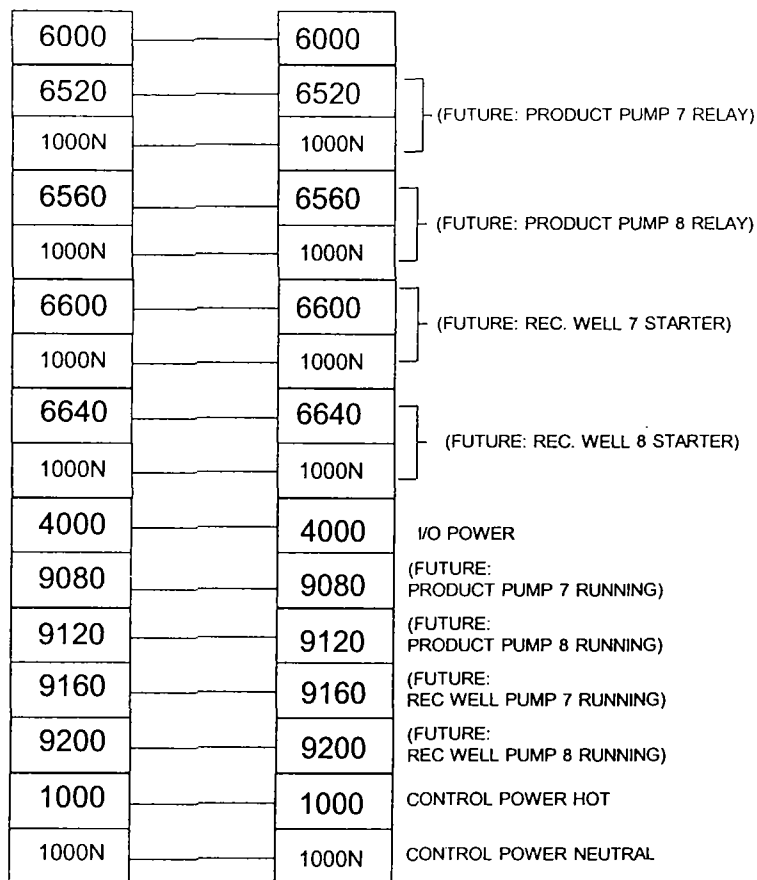
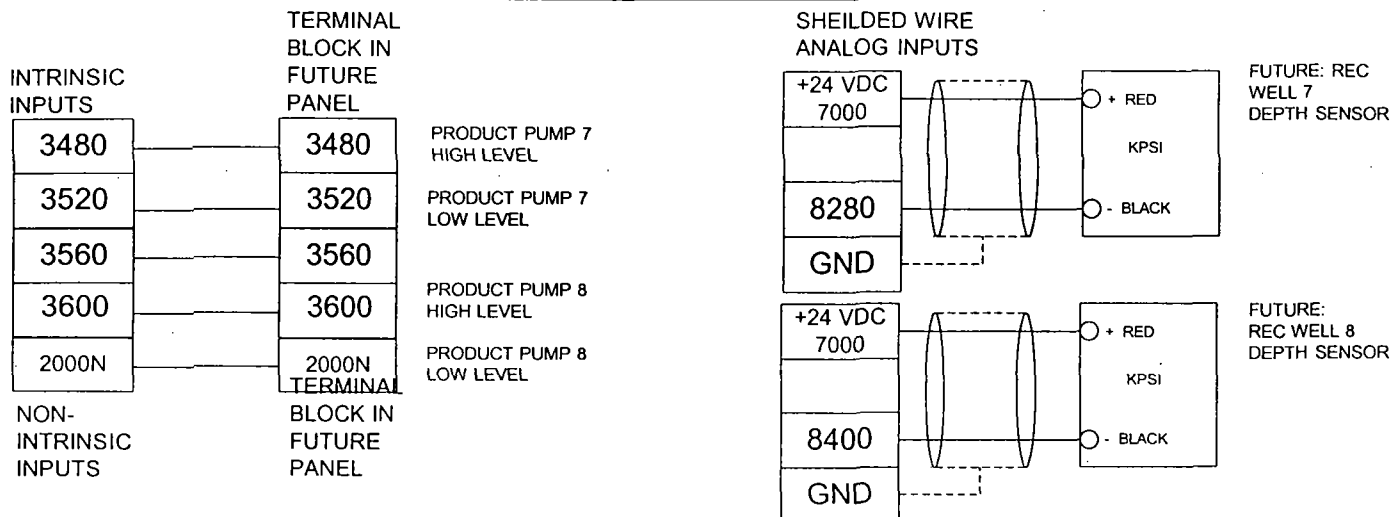
SHEILDED WIRE
ANALOG INPUTS




FIELD

[illegible]

**FUTURE : CONNECTION DIAGRAM FOR FIELD
DEVICES TO BE ADDED IN THE FUTURE**



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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SERVICE DATA

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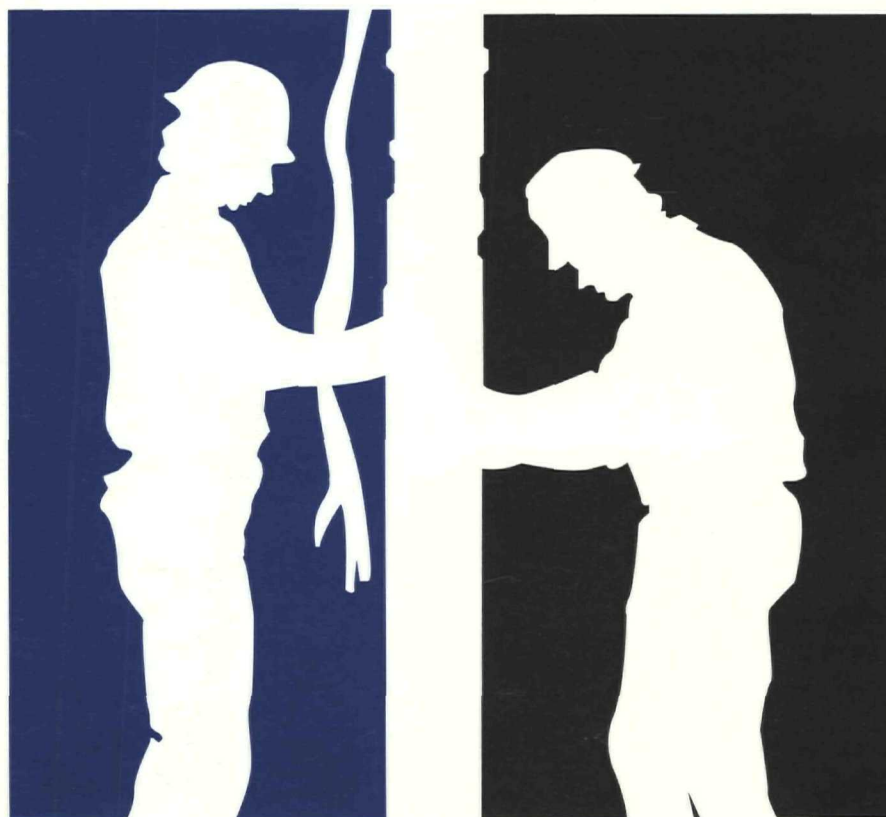
DATE: January 1, 1997

SUPERSEDES: 5-30-95

Submersible Motors

Application ■ Installation ■ Maintenance Manual

Water Well Motors, Single and Three Phase 60 HZ, 4", 6" and 8" Diameter



Franklin Electric

Quality In The Well

ATTENTION!
IMPORTANT INFORMATION FOR INSTALLERS OF THIS EQUIPMENT!

THIS EQUIPMENT IS INTENDED FOR INSTALLATION BY TECHNICALLY QUALIFIED PERSONNEL. FAILURE TO INSTALL IT IN COMPLIANCE WITH NATIONAL AND LOCAL ELECTRICAL CODES, AND WITH FRANKLIN ELECTRIC RECOMMENDATIONS, MAY RESULT IN ELECTRICAL SHOCK OR FIRE HAZARD, UNSATISFACTORY PERFORMANCE, AND EQUIPMENT FAILURE. FRANKLIN INSTALLATION INFORMATION IS AVAILABLE FROM PUMP MANUFACTURERS AND DISTRIBUTORS, AND DIRECTLY FROM FRANKLIN ELECTRIC. CALL FRANKLIN TOLL FREE 800-348-2420 FOR INFORMATION.

WARNING

SERIOUS OR FATAL ELECTRICAL SHOCK MAY RESULT FROM FAILURE TO CONNECT THE MOTOR, CONTROL ENCLOSURES, METAL PLUMBING, AND ALL OTHER METAL NEAR THE MOTOR OR CABLE, TO THE POWER SUPPLY GROUND TERMINAL USING WIRE NO SMALLER THAN MOTOR CABLE WIRES. TO REDUCE RISK OF ELECTRICAL SHOCK, DISCONNECT POWER BEFORE WORKING ON OR AROUND THE WATER SYSTEM. DO NOT USE MOTOR IN SWIMMING AREAS.

ATTENTION!
INFORMATIONS IMPORTANTES POUR L'INSTALLATEUR DE CET EQUIPEMENT.

CET EQUIPEMENT DOIT ETRE INTALLE PAR UN TECHNICIEN QUALIFIE. SI L'INSTALLATION N'EST PAS CONFORME AUX LOIS NATIONALES OU LOCALES AINSI QU'AUX RECOMMANDATIONS DE FRANKLIN ELECTRIC, UN CHOC ELECTRIQUE, LE FEU, UNE PERFORMANCE NON ACCEPTABLE, VOIRE MEME LE NON-FONCTIONNEMENT PEUVENT SURVENIR. UN GUIDE D'INSTALLATION DE FRANKLIN ELECTRIC EST DISPONIBLE CHEZ LES MANUFACTURIERS DE POMPES, LES DISTRIBUTEURS, OU DIRECTEMENT CHEZ FRANKLIN. POUR DE PLUS AMPLES RENSEIGNEMENTS, APPELEZ SANS FRAIS LE 800-348-2420.

AVERTISSEMENT

UN CHOC ELECTRIQUE SERIEUX OU MEME MORTEL EST POSSIBLE, SI L'ON NEGLIGE DE CONNECTER LE MOTEUR, LA PLOMBERIE METALLIQUE, BOITES DE CONTROLE ET TOUT METAL PROCHE DU MOTEUR A UN CABLE ALLANT VERS UNE ALIMENTATION D'ENERGIE AVEC BORNE DE MISE A LA TERRE UTILISANT AU MOINS LE MEME CALIBRE QUE LES FILS DU MOTEUR. POUR REDUIRE LE RISQUE DE CHOC ELECTRIQUE. COUPER LE COURANT AVANT DE TRAVAILLER PRES OU SUR LE SYSTEM D'EAU. NE PAS UTILISER CE MOTEUR DANS UNE ZONE DE BAIGNADE.

ATENCION!
INFORMACION PARA EL INSTALADOR DE ESTE EQUIPO.

PARA LA INSTALACION DE ESTE EQUIPO, SE REQUIERE DE PERSONAL TECNICO CALIFICADO. EL NO CUMPLIR CON LAS NORMAS ELECTRICAS NACIONALES Y LOCALES, ASI COMO CON LAS RECOMENDACIONES DE FRANKLIN ELECTRIC DURANTE SU INSTALACION, PUEDE OCASIONAR, UN CHOQUE ELECTRICO, PELIGRO DE UN INCENDIO, OPERACION DEFECTUOSA E INCLUSO LA DESCOMPOSTURA DEL EQUIPO. LOS MANUALES DE INSTALACION Y PUESTA EN MARCHA DE LOS EQUIPOS, ESTAN DISPONIBLES CON LOS DISTRIBUIDORES, FABRICANTES DE BOMBAS O DIRECTAMENTE CON FRANKLIN ELECTRIC. PUEDE LLAMAR GRATUITAMENTE PARA MAYOR INFORMACION AL TELEFONO 800-348-2420.

ADVERTENCIA

PUEDE OCURRIR UN CHOQUE ELECTRICO, SERIO O FATAL DEBIDO A UNA ERRONEA CONECCION DEL MOTOR, DE LOS TABLEROS ELECTRICOS, DE LA TUBERIA, DE CUALQUIER OTRA PARTE METALICA QUE ESTA CERCA DEL MOTOR O POR NO UTILIZAR UN CABLE PARA TIERRA DE CALIBRE IGUAL O MAYOR AL DE LA ALIMENTACION. PARA REDUCIR EL RIESGO DE CHOQUE ELECTRIC, DESCONECTAR LA ALIMENTACION ELECTRICA ANTES DE INICIAR A TRABAJAR EN EL SISTEMA HIDRAULICO. NO UTILIZAR ESTE MOTOR EN ALBERCAS O AREAS EN DONDE SE PRACTIQUE NATACION.

Transformer Capacity Required For Submersible Motors Single Phase or Three Phase

Distribution transformers must be adequately sized to satisfy the KVA requirements of the submersible motor. When transformers are too small to supply the load, there is a reduction in voltage to the motor.

Table 2 references the motor horsepower rating, single phase and three phase, total effective KVA required, and the smallest transformer required for open or closed three phase systems. Open systems require larger transformers since only two transformers are used.

Other loads would add directly to the KVA sizing requirements of the transformer bank.

Use of Engine Driven Generators Single Phase or Three Phase

Table 3 lists recommended generator sizes, based on typical 80°C rise continuous duty generators, with 35% maximum voltage dip during starting, for specific Franklin three wire motors, single or three phase.

This chart is conservative and it is recommended the generator manufacturer be consulted whenever possible, especially on larger sizes.

There are two types of generators available, externally and internally regulated. Most are externally regulated. They use an external mounted voltage regulator that senses the output voltage. As the voltage dips at motor start up, the regulator increases the output voltage of the generator.

Internally regulated generators have an extra winding in the generator stator and are also called self excited. The extra winding senses the output current to automatically increase the output voltage.

Generators must be sized to deliver at least 65% of the rated voltage during motor starting to ensure adequate motor starting torque. Besides sizing, generator frequency is all important as the motor speed varies with the frequency (HZ). Due to pump affinity laws a pump running at 1 to 2 HZ below motor nameplate frequency design will not meet its performance curve. Conversely, a pump running at 1 to 2 HZ above may trip overloads.

Generator Operation. Always start the generator before the motor is started, and always stop the motor before the generator is shut down. The motor thrust bearing may be damaged when generators are allowed to coast down with the motor connected. This same condition occurs when generators are allowed to run out of fuel.

Follow generator manufacturer's recommendations for derating at higher elevations or using natural gas.

WARNING: To prevent accidental electrocution, automatic or manual transfer switches must be used any time a generator is used as standby or back up on power lines. Contact power company for use and approval.

Table 2 TRANSFORMER CAPACITY

Motor HP	Total Effective KVA Required	Smallest KVA Rating - Each Transformer	
		Open WYE or DELTA 2 Transformers	Closed WYE or DELTA 3 Transformers
1 1/2	3	2	1
2	4	2	1.5
3	5	3	2
5	7.5	5	3
7 1/2	10	7.5	5
10	15	10	5
15	20	15	7.5
20	25	15	10
25	30	20	10
30	40	25	15
40	50	30	20
50	60	35	20
60	75	40	25
75	90	50	30
100	120	65	40
125	150	85	50
150	175	100	60
175	200	115	70
200	230	130	75

NOTE: TRANSFORMERS SHOWN ARE STANDARD NOMINAL KVA RATINGS. IF POWER COMPANY EXPERIENCE AND PRACTICE ALLOWS TRANSFORMER LOADING HIGHER THAN NOMINAL RATING UNDER THE SPECIFIC OPERATING CONDITIONS AND MAINTAINS CORRECT VOLTAGE AND BALANCE, SUCH HIGHER LOADING VALUES MAY BE USED FOR TRANSFORMER(S) TO MEET TOTAL EFFECTIVE KVA REQUIRED.

Table 3 ENGINE DRIVEN GENERATORS

Motor HP	Minimum Rating of Generator			
	Externally Regulated		Internally Regulated	
	KW	KVA	KW	KVA
1/3	1.5	1.9	1.2	1.5
1/2	2.0	2.5	1.5	1.9
3/4	3.0	3.8	2.0	2.5
1	4.0	5.0	2.5	3.125
1 1/2	5.0	6.25	3.0	3.8
2	7.5	9.4	4.0	5.0
3	10.0	12.5	5.0	6.25
5	15.0	18.75	7.5	9.4
7 1/2	20.0	25.0	10.0	12.5
10	30.0	37.5	15.0	18.8
15	40.0	50.0	20.0	25.0
20	60.0	75.0	25.0	31.0
25	75.0	94.0	30.0	37.5
30	100.0	125.0	40.0	50.0
40	100.0	125.0	50.0	62.5
50	150.0	188.0	60.0	75.0
60	175.0	220.0	75.0	94.0
75	250.0	313.0	100.0	125.0
100	300.0	375.0	150.0	188.0
125	375.0	469.0	175.0	219.0
150	450.0	563.0	200.0	250.0
175	525.0	656.0	250.0	313.0
200	600.0	750.0	275.0	344.0

NOTE: FOR BEST STARTING OF TWO-WIRE MOTOR MINIMUM GENERATOR RATINGS 50% HIGHER THAN SHOWN ARE RECOMMENDED.

Use of Check Valves

It is recommended that one or more check valves always be used in submersible pump installations. A line check valve, if the pump does not have a built-in check valve, should be installed in the discharge line within 25 feet of the pump and below the drawdown level of the water supply. For deeper settings, it is recommended that a line check valve be installed every 200 feet.

Swing type check valves should never be used with submersible pumps. When the pump stops, there is a sudden reversal of flow before the swing check closes, causing a sudden change in the velocity of the water. Spring loaded check valves should be used as they are designed to close quickly as the water flow stops and before it begins to move in the reverse direction. There is little or no velocity of flow when the spring loaded valve closes and no hydraulic shock or water hammer is produced by the closing of the valve.

Check valves are used to hold pressure in the system when the pump stops. They are also used to prevent backspin, waterhammer and upthrust. Any of these three or a combination of them can lead to immediate pump or motor failure, a shortened service life or operating problems in the system

A. Backspin - with no check valve or if the check valve fails, the water in the drop pipe and the water in the system can flow back down the discharge pipe when the motor stops. This can cause the pump to rotate in a reverse direction as the water flows back down the pipe. If the motor is started while this is happening, a heavy strain may be placed across the pump-motor assembly. It can also cause excessive thrust bearing wear because the motor is not turning fast enough to ensure an adequate film of water in the thrust bearing.

B. Upthrust - with no check valve, or with a leaking check valve, the unit starts each time under zero head conditions. With most pumps, this causes an uplifting or upthrust on the impellers-shaft assembly in the pump. This upward movement carries across the pump-motor coupling and creates an upthrust condition in the motor. Repeated upthrust at each start can cause premature wear and failure of either or both the pump and the motor.

C. Water Hammer - If the lowest check valve is more than 30 feet above the standing water level or the lower check valve leaks and the check valve above holds, a partial vacuum is created in the discharge piping. On the next pump start, water moving at very high velocity fills the void and strikes the closed check valve and the stationary water in the pipe above it, causing a hydraulic shock. This shock can split pipes, break joints and damage the pump and/or motor. Water hammer is an easily detected noise. When discovered, the system should be shut down and the pump installer contacted to correct the problem.

Only positive sealing check valves should be used. Using drilled or drainback check valves will prevent backspin. However, they create upthrust and water hammer problems.

Wells-Large Diameter, Uncased Top feeding & Screened Sections

Franklin Electric submersible motors are designed to operate with a cooling flow of water over the motor.

If the pump installation does not ensure at least the minimum flow shown in Table 5, a flow inducer sleeve as shown in FIG. 1 must be used. Some conditions requiring a flow sleeve are:

- Well diameter is too large to meet Table 5 flow requirements.
- Pump is in an open body of water.
- Pump is in a rock well or below the end of the well casing.
- The well is "top-feeding".
- Pump is set in or below any part of screens or perforations.

Effects of Torque

During the starting of a submersible pump, the torque developed by the motor must be supported through the pump, delivery pipe or other supports. Most pumps rotate in the direction which causes unscrewing torque on right hand threaded pipe or pump stages. All threaded joints, pumps and other parts of the pump support system must be capable of withstanding the maximum torque repeatedly without loosening or breaking. Unscrewing joints will break the electrical cable and may cause loss of the pump-motor unit.

To safely withstand maximum unscrewing torques with a minimum safety factor of 1.5, tightening all threaded joints to at least 10 lb. ft per motor horsepower is recommended. It may be necessary to tack or strap weld pipe joints on high horsepower pumps, especially at shallower settings.

Table 4 Torque Required (Examples)

Motor H.P. Rating	x 10 Lb. Ft.	Minimum Safe Torque-Load
1 HP & Less	1 x 10	10 Lb. Ft.
20 HP	20 x 10	200 Lb. Ft.
75 HP	75 x 10	750 Lb. Ft.
200 HP	200 x 10	2,000 Lb. Ft.

Submersible Motors

Application ■ Installation Maintenance Manual

The submersible motor is a reliable, efficient and trouble free means of powering a pump. Its needs for a long operation life are simple. They are:

1. A suitable operating environment
2. An adequate supply of electricity
3. An adequate flow of cooling water over the motor

All of the considerations of application, installation and maintenance of submersible motors relate to these three things. The purpose of this manual is to acquaint you with these needs to help you assure that these needs are being met and to assist and direct you if service or maintenance is ever required.

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Storage

Franklin Electric submersible motors are a water lubricated design. The filling solution consists of a mixture of deionized water and Propylene Glycol, a non-toxic antifreeze. The solution will prevent damage from freezing for temperatures down to -40°F (-40°C). Repeated freezing and thawing should be avoided to prevent possible loss of solution.

There may be an interchange of filling solution with well water during operation. Care must be taken with motors removed from wells during freezing conditions to prevent damage.

When the storage temperature does not exceed 100°F, (37°C), storage time should be limited to two years. Where temperatures reach 130°F, (54°C), storage time should be limited to one year.

Loss of a few drops of liquid will not damage the motor as an excess amount is provided, and the filter check valve will allow lost liquid to be replaced by filtered well water upon installation. If there is reason to believe there has been a considerable amount of leakage, consult the factory for checking procedures.

Frequency of Starts

The average number of starts per day over a period of months or years influences the life of a submersible pumping system. Excessive cycling affects the life of control components such as pressure switches, starters, relays and capacitors, plus splines and bearings. Rapid cycling can also cause motor overheating and winding failures.

The pump size, tank size and other controls should be selected to keep the starts per day as low as practical for longest life, based upon the maximum number of starts per 24 hour day, as shown in Table 1.

Motors should be allowed to run a minimum of one minute to dissipate heat build up from starting current.

Mounting Position

Motors are suitable for operation in mounting positions from vertical shaft up to horizontal. If 4 inch motors thru 2 HP are started more than 10 times per day, it is recommended the shaft be tilted up at 15° from horizontal to minimize coast-down wear of the upthrust washer.

Table 1 Number of Starts

Motor Rating	Maximum Starts Per 24 Hr. Day	
	Single Phase	Three Phase
Up to 3/4 HP	300	300
1 HP thru 5 HP	100	300
7 1/2 HP thru 30 HP	50	100
40 HP and over		100

Water Temperature and Flow

Franklin Electric submersible motors are designed to operate with loading up to maximum service factor horsepower in water up to 86 degrees F (30°C) with a water flow past the motor of 0.25 ft/sec for 4" High Thrust motors and 0.5 ft/sec for 6 & 8 inch motors. Table 5 shows minimum flow rates, in GPM, for various well diameters and motor sizes.

If the motors are operated in water over 86 degrees F (30°C), water flow past the motor and/or the motor horsepower must be increased to maintain safe motor operating temperatures as shown in HOT WATER APPLICATIONS on page 6.

Table 5 Required Cooling Flow

Minimum GPM required for motor cooling in water up to 86°F (30°C).

Inches Casing or Sleeve I.D.	4" High Thrust Motor .25 ft/sec GPM	6" Motor .5 ft/sec GPM	8" Motor .5 ft/sec GPM
4	1.2	—	—
5	7	—	—
6	13	9	—
7	20	25	—
8	30	45	10
10	50	90	55
12	80	140	110
14	110	200	170
16	150	280	245

.25 ft/sec = 7.62 cm/sec

.50 ft/sec = 15.24 cm/sec

1 inch = 2.54 cm

Head Loss From Flow Past Motor

The following lists the approximate feet of head loss from flow between an average length motor and smooth casing or flow inducer sleeve.

Table 6 Head Loss Past Motor

Motor (Nominal)		4"	4"	4"	6"	6"	6"	8"	8"
Casing I.D. Inches		4.026"	5"	6"	6"	7"	8"	8.1"	10"
GPM	25	0.3							
	50	1.2							
	100	4.7	0.3		1.7				
	150	10.2	0.6	0.2	3.7				
	200		1.1	0.4	6.3	0.5		6.8	
	250		1.8	0.7	9.6	0.8		10.4	
	300		2.5	1.0	13.6	1.2	0.2	14.6	
	400				23.7	2.0	0.4	24.6	
	500					3.1	0.7	37.3	0.6
	600					4.4	1.0	52.2	0.8
	800								1.5
	1000								2.4

Flow Inducer Sleeve

If the flow rate is less than specified or coming from above the pump, then a flow inducer sleeve must be added for motor cooling. A flow sleeve is always required in an open body of water. FIG 1. shows a typical flow inducer sleeve construction.

Example: A six-inch motor and pump that delivers 60 GPM will be installed in a 10" well, 90 GPM past the motor is required in a 10" I.D. well. An 8" or smaller sleeve must be added to the pump to provide a cooling flow of water past the motor.

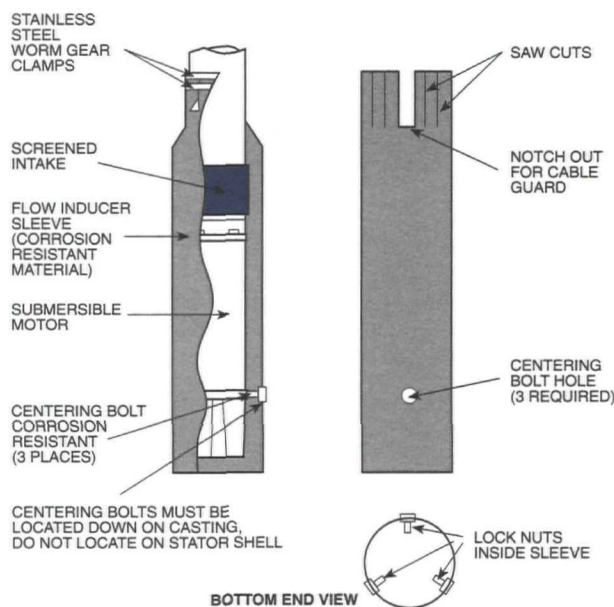


FIG 1

Hot Water Applications

When the pump-motor operates in water hotter than 86°F (30°C), the best motor cooling and most economical motor result when a flow rate of at least 3 ft/sec is provided.

When selecting the correct motor to drive a pump at elevated water temperatures, and 3 ft/sec the flow rate pump horsepower required and water temperature must be used with a heat factor multiplier to calculate the rated HP motor needed.

1. The flow past the motor must be a minimum of 3 ft/second. Using Chart A, determine pump GPM delivery required for different well or sleeve diameters and motor sizes. If necessary, add a flow sleeve to obtain at least 3 ft/sec flow rate.

2. Determine pump horsepower required from the pump manufacturer's curve.

3. Multiply the pump horsepower required by the heat factor multiplier from Chart B.

4. Select a rated HP motor on Chart C whose SFHP is at least the value calculated in Item 3.

Chart A — Minimum GPM Required to Obtain 3 ft/sec Flow Rate

Inches Casing or Sleeve I.D.	4" High Thrust Motor GPM	6" Motor GPM	8" Motor GPM
4	15	—	—
5	80	—	—
6	160	52	—
7	—	150	—
8	—	260	60
10	—	520	330
12	—	—	650
14	—	—	1020
16	—	—	1460

Manufacturer's Pump Curve

FIG 2

Chart B — Heat Factor Multiplier at 3 ft/sec Flow Rate

Maximum Water Temp	1/3 — 5 HP	7 1/2 — 30 HP	Over 30 HP
140°F (60°C)	1.25	1.62	2.00
131°F (55°C)	1.11	1.32	1.62
122°F (50°C)	1.00	1.14	1.32
113°F (45°C)	1.00	1.00	1.14
104°F (40°C)	1.00	1.00	1.00
95°F (35°C)	1.00	1.00	1.00

Chart C — Service Factor Horsepower

HP	SFHP	HP	SFHP	HP	SFHP	HP	SFHP
1/3	.58	3	3.45	25	27.50	100	115.00
1/2	.80	5	5.75	30	34.50	125	143.75
3/4	1.12	7 1/2	8.65	40	46.00	150	172.50
1	1.40	10	11.50	50	57.50	175	201.25
1 1/2	1.95	15	17.25	60	69.00	200	230.00
2	2.50	20	23.00	75	86.25		

Hot Water Applications - Example

EXAMPLE: A 6" pump end requiring 39 HP input will pump 124°F water in an 8" well at a delivery rate of 140 GPM. From Chart A, a 6" flow sleeve will be required to increase the flow rate to at least 3 ft/sec.

Using Chart B, the 1.62 heat factor multiplier is selected because the HP required is over 30 HP and water temperature above 122°F. Multiply 39 x 1.62 which equals 63.2. This is the minimum service factor horsepower motor which is usable at 39 HP in 124°F water. Using Chart C, select a motor with a service factor horsepower above 63.2. A 60 HP motor has a service factor horsepower of 69, so a 60 HP motor may safely be used.

	F	Degrees C or F	C	
		260	127	
		250	121	
		240	115	
		230	110	
		220	104	
		210	99	
		200	93	
		190	88	
		180	82	
		170	77	
		160	71	
		150	65	
		140	60	
	266	130	54	
	248	120	49	
	230	110	43	
	212	100	38	
	194	90	32	
	176	80	27	
	158	70	21	
	140	60	15	
	122	50	10	
	104	40	4	
	86	30	-1	
	68	20	-7	
	50	10	-12	
	32	0	-18	
	14	-10	-23	
	-4	-20	-29	
	-22	-30	-34	
	-40	-40	-40	

FIG 3

Temperature Conversion

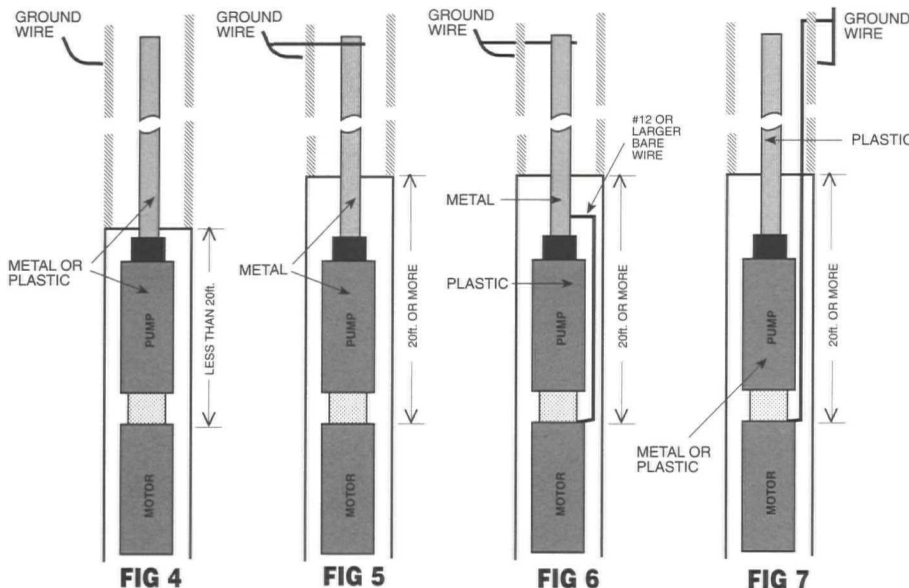
Grounding Control Boxes and Panels

The National Electrical Code requires that the control box or panel grounding terminal always be connected to circuits which include a grounding conductor. If the circuit has no grounding conductor and no metal conduit from the box to supply panel, use a wire at least as large as line conductors and connect as required by the NEC, from the grounding terminal to the electrical supply ground.

WARNING: Failure to ground the control frame can result in a serious electrical shock hazard if a circuit fault occurs.

Grounding lightning arrestors

An above ground lightning arrestor must be grounded, metal to metal, all the way to the water strata for the lightning arrestor to be effective. **GROUNDING THE ARRESTOR TO THE SUPPLY GROUND OR TO A DRIVEN GROUND ROD PROVIDES LITTLE OR NO PROTECTION FOR THE MOTOR.**



In some areas, electrical codes require a ground wire from a submersible motor to the panel and supply ground. This provides maximum protection with above ground arrestors. In locations where this ground wire is not required by code, there are three acceptable ways of grounding above ground lightning arrestors:

1. When metallic well casing extends within at most 20 feet of the motor, the arrestor should be grounded to the well casing with a No. 12 or larger wire. See Figure 4.
2. If the well casing is plastic or terminates more than 20 feet above the motor, and metal drop pipe is used, then the best available protection is provided by grounding the arrestor to the metal drop pipe. See Figure 5. If the pump is electrically insulated from the motor as it would be with a nonmetallic pump adaptor bracket, then a wire should connect the drop pipe to the motor studs. See Figure 6.
3. If the well casing is nonmetallic or terminates more than 20 feet above the motor and nonmetallic drop pipe is used, then protection is only provided when the arrestor is grounded to a No. 12 or larger bare copper wire run with the power cable to the motor and connected to a motor stud. This wire should also connect to the top of the well casing if metallic. See Figure 7.

Control Box and Panel Environment

Franklin Electric control boxes meet U.L. requirements for Type 3R enclosures. They are suitable for indoor and outdoor applications within temperatures of +14°F, (-10°C) to 122°F, (50°C). Operating control boxes below +14°F can cause reduced starting torque and loss of overload protection when overloads are located in control boxes. During coldest weather, temperature may be kept above +14°F by having an enclosure around the control box and using heat tape or a small light bulb in the enclosure as a heat source.

Control boxes and panels should never be mounted in direct sunlight or high temperature locations as this will cause shortened

capacitor life and unnecessary tripping of overload protectors. A ventilated enclosure painted white to reflect heat is recommended for outdoor high temperature locations.

The worst place to mount a control box is in a damp well pit, or other humid location, as this accelerates component failure from voltage breakdown and corrosion.

Control boxes with voltage relays are designed for vertical upright mounting only. Mounting in other positions will affect the operation of the relay.

3-Wire Control Boxes

Single phase three wire submersible motors require the use of above ground control boxes. Operation of motors without control boxes or with incorrect boxes can result in failure of motors and voids warranty.

Control boxes contain starting capacitors, starting relay, and in some sizes overload protector running capacitors.

Ratings through 1 HP may use either a solid state, current or a potential (voltage) type starting relay, while larger ratings use potential relays.

CAUTION:

Be certain that control box HP and voltage match the motor.

Potential (Voltage) Relays —

Before the power is applied the starting relay contacts are closed. When the power is applied, both start and main motor windings are energized, and the motor starts. At this instant the voltage across the start winding is relatively low, not enough to open the contacts of the starting relay.

As the motor comes up to speed, the voltage across the start winding (and the starting relay coil) increases enough to pick up the starting relay and open its contacts. This opens the starting circuit and the motor continues to run on the main winding alone, or the main plus running capacitor circuit and the relay contacts remain open.

Current Relays —

Before power is applied the starting relay contacts are open. When power is applied the high main winding current through the relay coil immediately closes the contacts, energizing the start winding and starting the motor. As the motor comes up to running speed, current through the relay coil gradually drops and allows the contacts to open the start winding circuit, and the motor completes acceleration and runs on the main winding.

Solid State Relays

There are two simple elements in the solid state starting relay, a reed switch and a triac. The reed switch consists of two tiny rectangular blade-type contacts which bend under magnetic flux. It is hermetically sealed in glass and is located within a coil which conducts line current. When power is supplied to the control box, the high main winding current through the coil immediately closes the reed switch contacts. This turns on the triac, which supplies voltage to the start winding, thus starting the motor.

Once the motor is started, the operation of the solid state relay is a complex interaction between the triac, the reed switch and the motor windings. Basically, the solid state switch senses motor speed by means of the changing phase relationship between start winding current and line current. As the motor approaches running speed, the phase angle between the sine wave of the start current and the sine wave of the line current become nearly in-phase. At this point, the reed switch contacts open, turning off the triac. This removes voltage from the start winding and the motor continues to run on the main winding only. With the reed switch contacts open and the triac turned off, the solid state relay is ready for the next starting cycle.

2-Wire Motor Solid State Controls BIAC Switch Operation

When power is applied to the two motor leads the bi-metal switch contacts are closed so the triac is conducting. This allows current to pass through the start winding, thus starting the motor. The Biac switch responds to voltage from a sensor coil located inside the motor. This sensor coil voltage is proportional to motor RPM. As RPM increases the increased voltage in the sensor coil generates heat in one of the two bi-metal strips, causing this bi-metal strip to bend away from the other bi-metal strip, thus opening the switch circuit. This removes the starting winding current and the motor continues to run on the main winding alone.

Approximately 5 seconds after power is removed from the motor, the bi-metal strip cools sufficiently to return to its upright position, reclose the contacts, and the motor is ready for the next start cycle. If, during operation, the motor speed drops for some reason, the lowered voltage in the sensor coil allows the bi-metal contacts to re-close, supplying start winding current to bring the motor back to operating speed.

Reverse Impact Torque

This unique torque reversing feature will minimize the problems of sandy environments. In a locked rotor condition, the Biac switch will supply full start winding current for approximately one second. Then the switch begins opening and closing very rapidly. This action chops the start winding current, switching the start winding current between leading and lagging the run winding current. This produces impact torque in both forward and reverse directions. This reverse impact torque will literally shake many obstructions loose. Once cleared, the motor will run in the proper rotation.

Extreme Fast Cycling (Due to Water-Logged Tank)

The Biac starting switch will reset within approx. 5 seconds after the motor is stopped. If an attempt is made to restart the motor before the starting switch has reset, the motor may not start; however, there will be current flow through the main winding until the overload protector interrupts the circuit. The time for the protector to reset is longer than the reset of the starting switch. Therefore, the start winding switch will have closed and the motor will operate. The repeated on-off cycle will continue until the overload again trips out.

When a severely water-logged condition does occur, the user will be alerted to the problem during the off time (overload reset time) since the pressure will drop drastically. When the water-logged tank condition is detected the condition should be corrected to prevent nuisance tripping of the overload protector.

Bound Pump (Sandlocked)

When the motor is not free to turn, as with a sandlocked pump, the Biac switch creates a "reverse impact torque" in the motor in either direction. When the sand is dislodged, the motor will start and operate in the correct direction.

Two or Three Wire Cable, 60 HZ (Service Entrance to Motor - Maximum Length In Feet)

Table 7

Motor Rating		AWG Copper Wire Size												
Volts	HP	14	12	10	8	6	4	3	2	1	0	00	000	0000
115	1/3	130	210	340	540	840	1300	1610	1960	2390	2910	3540	4210	5060
	1/2	100	160	250	390	620	960	1190	1460	1780	2160	2630	3140	3770
230	1/3	550	880	1390	2190	3400	5250	6520	7960	9690	11770			
	1/2	400	650	1020	1610	2510	3880	4810	5880	7170	8720			
	3/4	300	480	760	1200	1870	2890	3580	4370	5330	6470	7870		
	1	250	400	630	990	1540	2380	2960	3610	4410	5360	6520		
	1 1/2	190	310	480	770	1200	1870	2320	2850	3500	4280	5240		
	2	150	250	390	620	970	1530	1910	2360	2930	3620	4480		
	3	120*	190	300	470	750	1190	1490	1850	2320	2890	3610		
	5	0	0	180*	280	450	710	890	1110	1390	1740	2170	2680	
	7 1/2	0	0	0	200*	310	490	610	750	930	1140	1410	1720	
	10	0	0	0	0	250*	390	490	600	750	930	1160	1430	1760
	15	0	0	0	0	170*	270*	340	430	530	660	820	1020	1260

1 Foot = .3048 Meter

Lengths without the asterisk * meet the U.S. National Electrical Code ampacity for either individual conductors or jacketed 60°C cable.

Lengths marked * meet the NEC ampacity only for individual conductor 60°C cable in free air or water, not in conduit. If cable rated other than 60°C is used, lengths remain unchanged, but the minimum size acceptable for each rating must be based on the NEC Table column for that temperature cable.

Flat molded cable is considered to be jacketed cable.

Maximum lengths shown maintain motor voltage at 95% of service entrance voltage, running at maximum nameplate amperes. If service entrance voltage will be at least motor nameplate voltage under normal load conditions, 50% additional length is permissible for all sizes.

This table is based on copper wire. If aluminum wire is to be used; it must be two sizes larger. Example: If the table calls for #12 copper wire, #10 aluminum wire would be required.

The portion of the total cable length which is between the supply and single phase control box with line contactor should not exceed 25% of the total maximum allowable, to ensure reliable contactor operation. Single phase control boxes without line contactors may be connected at any point in the total cable length.

Lengths represent a 5% voltage drop. If 3% is required, multiply by .6 for maximum feet.

Contact Franklin for 75°C or 90°C cable lengths.

See pages 12, 31 and 33 for applying 230 V motors on 208 V power systems.

CAUTION — USE OF SMALLER THAN RECOMMENDED CABLE VOIDS WARRANTY, CAN CAUSE FAILURE OF THE MOTOR TO START AND OPERATE PROPERLY, AND MAY CAUSE CABLE OVERHEATING!

Two different cable sizes can be used.

The example below is for reference. Depending on the installation, any number of combinations may be used, as long as the total percent-

EXAMPLE: 3 HP, 230 Volt, 1 PH Motor

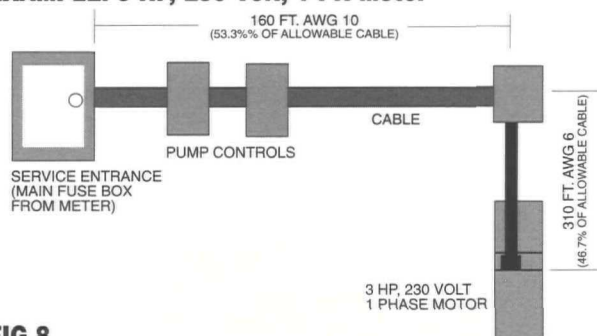


FIG 8

age length of the two cables used does not exceed 100%. This is to insure that adequate voltage will be supplied to the motor.

In a replacement installation, the well already has 160 feet of buried #10 cable between the service entrance and the well head. The question is: What size cable is required in the well with a 3 HP, 230 volt, 1 PH motor setting at 310 feet?

1. According to the table #10 cable is large enough for the 3 HP motor so the percent of the maximum allowable cable used by the 160-foot run is $160 \div 300 = 53.3\%$, since 300 feet is the total allowable.

2. With 53.3% of the total allowable cable already used between the service entrance and the well head, only 46.7% is left for the well. Therefore, the 310 feet needed in the well can only utilize 46.7% of the total feet allowed in the table.

3. From the table, 46.7% of the 470 feet for #8 cable equals only 220 feet, so a larger size is needed. For #6, 46.7% of 750 feet = 350 feet. As a result, #6 can be used for the 310 feet in the well.

Application Single Phase Motors

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Table 8 Single Phase Motor Specifications (60 Hertz) 3450 RPM

Type	Motor Model Prefix					Rated Input		Maximum (S.F. Load)		(1) Line to Line Res. M = Main S = Start	Efficiency %			Power Factor %			Locked Rotor Amps	KVA Code	Circuit Breaker or Fuse AMPS	
		HP	Volts	HZ	S.F.	(2) Amps	Watts	(2) Amps	Watts		S.F.	F.L.	3/4	S.F.	F.L.	3/4			Std.	Delay
4 Inch Two Wire	244502	1/3	115	60	1.75	8.0	480	9.2	720	1.4-1.8	60.0	51.0	44.8	71.0	53.5	46.5	48.4	S	25	10
	244503	1/3	230	60	1.75	4.0	480	4.6	720	6.0-7.4	60.0	51.0	44.8	71.0	53.5	46.5	24.2	S	15	5
	244504	1/2	115	60	1.60	10.0	680	12.0	970	1.0-1.3	61.5	55.0	48.8	72.5	57.5	49.7	64.4	R	30	15
	244505	1/2	230	60	1.60	5.0	680	6.0	970	4.2-5.2	61.5	55.0	48.8	72.5	57.5	49.7	32.2	R	15	7
	244507	3/4	230	60	1.50	6.8	950	8.0	1325	3.0-3.6	63.5	59.0	53.2	74.0	61.5	53.2	40.7	N	20	9
	244508	1	230	60	1.40	8.2	1200	9.8	1600	2.2-2.7	65.0	62.2	57.4	74.0	62.5	53.5	48.7	M	25	12
	244309	1 1/2	230	60	1.30	10.6	1780	13.1	2250	1.5-1.9	65.0	62.8	59.4	79.7	74.2	66.1	56.8	L	35	15
4 Inch Three Wire	214502	1/3	115	60	1.75	Y8.0 B8.0 R0	480	Y9.2 B9.2 R0	720	1.4-1.8M 6.5-7.9S	60.0	51.0	44.8	71.0	53.5	46.5	34.8	N	25	10
	214503	1/3	230	60	1.75	Y4.0 B4.0 R0	480	Y4.6 B4.6 R0	720	6.0-7.4M 26.1-32S	60.0	51.0	44.8	71.0	53.5	46.5	17.2	N	15	5
	214504	1/2	115	60	1.60	Y10.0 B10.0 R0	680	Y12.0 B12.0 R0	970	1.0-1.3M 4.1-5.1S	61.5	55.0	48.8	72.5	57.5	49.7	50.5	M	30	15
	214505	1/2	230	60	1.60	Y5.0 B5.0 R0	680	Y6.0 B6.0 R0	970	4.2-5.2M 16.7-20.5S	61.5	55.0	48.8	72.5	57.5	49.7	23.0	M	15	7
	214507	3/4	230	60	1.50	Y6.8 B6.8 R0	950	Y8.0 B8.0 R0	1325	3.0-3.6M 11.0-13.4S	63.5	59.0	53.2	74.0	61.5	53.2	34.2	M	20	9
	214508	1	230	60	1.40	Y8.2 B8.2 R0	1200	Y9.8 B9.8 R0	1600	2.2-2.7M 10.1-12.3S	65.0	62.2	57.4	74.0	62.5	53.5	41.8	L	25	12
4 Inch 3 Wire W-Run Cap	224300	1 1/2	230	60	1.30	Y10.0 B9.9 R1.3	1700	Y11.5 B11.0 R1.3	2150	1.5-2.3M 6.2-12.0S	67.9	66.0	62.0	81.4	74.4	66.1	52.0	J	30	15
	224301	2	230	60	1.25	Y10.0 B9.3 R2.6	2100	Y13.2 B11.9 R 2.6	2650	1.6-2.3M 5.2-7.15S	70.0	71.0	68.8	93.1	90.5	86.7	51.0	G	30	15
	224302	3	230	60	1.15	Y14.0 B12.2 R4.7	3150	Y17.0 B14.5 R4.5	3650	.9-1.5M 3.0-4.9S	70.9	71.8	69.6	98.0	97.5	96.0	82.0	G	45	20
	224303	5	230	60	1.15	Y23.0 B19.1 R8.0	5100	Y27.5 B23.2 R7.8	5900	.68-1.0M 2.1-2.8S	71.1	71.9	70.0	97.5	96.4	94.0	121.0	F	70	30
6 Inch	226110	5	230	60	1.15	Y23.0 B18.2 R8.0	5000	Y27.5 B23.2 R7.8	5700	.55-.68M 1.3-1.6S	75.8	75.0	72.2	98.0	98.3	98.5	99.0	E	70	30
	226111	7 1/2	230	60	1.15	Y36.5 B34.4 R5.5	7300	Y42.1 B40.5 R5.4	8800	.36-.50M .92-1.2S	73.4	74.4	74.2	91.0	90.4	87.2	165.0	F	100	45
	226112	10	230	60	1.15	Y44.0 B39.5 R9.3	9800	Y51.0 B47.5 R8.9	11300	.27-.33M .80-.99S	76.2	76.8	76.3	95.8	95.8	95.3	204.0	E	150	60
	226113	15	230	60	1.15	Y62.0 B52.0 R17.5	13900	Y75.0 B62.5 R16.9	16200	.17-.22M .68-.93S	79.4	80.3	79.7	97.3	97.9	98.2	303.0	E	200	80

(1) Main winding - black to yellow
Start winding - red to yellow

(2) Y = Yellow lead, line amps
B = Black lead, main winding amps
R = Red lead, start or auxiliary winding amps

Auxiliary Running Capacitors for Noisy Installations

The addition of auxiliary running capacitors as a method of reducing noise in submersible installations is not reliable in all cases, but in some installations does reduce the noise to an acceptable level. In some cases, there is space in the control box to add an additional running capacitor or capacitors. In others, there is not room and the additional capacitor(s) should be mounted in an auxiliary box and used in conjunction with the regular control box.

Added capacitors must be connected across "Red" and "Black" control box terminals, in parallel with any existing running capacitors. Given below are the values of additional running capacitors most likely to reduce noise in cases where it may be a problem. The tabulation also gives the running capacitors originally supplied in each rating control box and the S.F. amps normally in each lead with the added capacitor.

Table 9 Auxiliary Capacitor Sizing

Motor Rating		Normal Running Capacitor(s) Mfd.	Auxiliary Running Capacitors For Noise Reduction			S.F. Amps (with Run Cap)		
HP	Volts		Mfd.	Min. Volts	Franklin Part	Yellow	Black	Red
1/3	115	0	45(1)	370	One 155327109	6.3	5.3	2.9
1/2		0	60(1)	240	Two 155328108	8.4	7.0	4.0
1/3	230	0	10(1)	370	One 155328102	3.3	3.1	1.2
1/2		0	15(1)	370	One 155328101	4.2	3.5	2.0
3/4		0	20(1)	370	One 155328103	5.8	5.0	2.5
1		0	25(1)	370	One ea. 155328101 155328102	7.1	5.6	3.4
1 1/2		10	20	370	One 155328103	9.3	7.5	4.4
2		20	10	370	One 155328102	11.2	9.2	3.8
3		35	10	370	One 155328102	16.1	13.0	5.9
5		60	None			27.5	23.2	7.8
7 1/2		45	45	370	One ea. 155327101 155328101	37	32	11.3
10		70	30	370	One 155327101	49	42	13
15		135	None			75	62.5	16.9

(1) **Do not** add running capacitors to standard production 1/3 through 1 HP control boxes which use current relays, solid state starting switches or QD relays! Adding capacitors will cause switch failure. If the control box is converted to use a voltage relay, the specified running capacitance can be added.

Buck-Boost Transformers

When the available power supply voltage is not within the proper range for a standard or available motor, a buck-boost transformer is often used to adjust voltage to match the motor. While tables to give a wide range of voltage boost or buck are published by transformer manufacturers, the following table shows Franklin recommendations for the most common usage on

submersible motors, boosting a 208 volt supply to use a standard 230 volt single phase submersible motor and control. The table, based on boosting the voltage 10%, shows the minimum rated transformer KVA needed to supply the 10% boost, and the common standard transformer KVA.

Table 10 Buck-Boost Transformer Sizing

Motor HP	1/3	1/2	3/4	1	1 1/2	2	3	5	7 1/2	10	15
Load KVA	1.02	1.36	1.84	2.21	2.65	3.04	3.91	6.33	9.66	11.7	16.6
MIN XFMR KVA	.11	.14	.19	.22	.27	.31	.40	.64	.97	1.2	1.7
STD XFMR KVA	.25	.25	.25	.25	.50	.50	.50	.75	1.0	1.5	2.0

Buck-Boost transformers are power transformers, not control transformers. They may also be used to lower voltage when the available power supply voltage is too high.

Table 11 Three Phase Cable, 60 Hz (Service Entrance to Motor) Maximum Length In Feet

Motor Rating		AWG Copper Wire Size												MCM Copper Wire Size					
Volts	HP	14	12	10	8	6	4	3	2	1	0	00	000	0000	250	300	350	400	500
200V 60 Hz Three Phase Three Wire	1/2	710	1140	1800	2840	4420													
	3/4	510	810	1280	2030	3160													
	1	430	690	1080	1710	2670	4140	5140											
	1 1/2	310	500	790	1260	1960	3050	3780											
	2	240	390	610	970	1520	2360	2940	3610	4430	5420								
	3	180	290	470	740	1160	1810	2250	2760	3390	4130								
	5	110*	170	280	440	690	1080	1350	1660	2040	2490	3050	3670	4440	5030				
	7 1/2	0	0	200	310	490	770	960	1180	1450	1770	2170	2600	3150	3560				
	10	0	0	0	230*	370	570	720	880	1090	1330	1640	1970	2390	2720	3100	3480	3800	4420
	15	0	0	0	160*	250*	390	490	600	740	910	1110	1340	1630	1850	2100	2350	2570	2980
	20	0	0	0	0	190*	300*	380	460	570	700	860	1050	1270	1440	1650	1850	2020	2360
	25	0	0	0	0	0	240*	300*	370*	460	570	700	840	1030	1170	1330	1500	1640	1900
	30	0	0	0	0	0	0	250*	310*	380*	470	580	700	850	970	1110	1250	1360	1590
230V 60 Hz Three Phase Three Wire	1/2	930	1490	2350	3700	5760	8910												
	3/4	670	1080	1700	2580	4190	6490	8060	9860										
	1	560	910	1430	2260	3520	5460	6780	8290										
	1 1/2	420	670	1060	1670	2610	4050	5030	6160	7530	9170								
	2	320	510	810	1280	2010	3130	3890	4770	5860	7170	8780							
	3	240	390	620	990	1540	2400	2980	3660	4480	5470	6690	8020	9680					
	5	140*	230	370	590	920	1430	1790	2190	2690	3290	4030	4850	5870	6650	7560	8460	9220	
	7 1/2	0	160*	260	420	650	1020	1270	1560	1920	2340	2870	3440	4160	4710	5340	5970	6500	7510
	10	0	0	190*	310	490	760	950	1170	1440	1760	2160	2610	3160	3590	4100	4600	5020	5840
	15	0	0	0	210*	330	520	650	800	980	1200	1470	1780	2150	2440	2780	3110	3400	3940
	20	0	0	0	0	250*	400	500	610	760	930	1140	1380	1680	1910	2180	2450	2680	3120
	25	0	0	0	0	0	320*	400	500	610	750	920	1120	1360	1540	1760	1980	2160	2520
	30	0	0	0	0	0	260*	330*	410*	510	620	760	930	1130	1280	1470	1650	1800	2110
460V 60Hz Three Phase Three Wire	1/2	3770	6020	9460															
	3/4	2730	4350	6850															
	1	2300	3670	5770	9070														
	1 1/2	1700	2710	4270	6730														
	2	1300	2070	3270	5150	8050													
	3	1000	1600	2520	3970	6200													
	5	590	950	1500	2360	3700	5750												
	7 1/2	420	680	1070	1690	2640	4100	5100	6260	7680									
	10	310	500	790	1250	1960	3050	3800	4680	5750	7050								
	15	0	340*	540	850	1340	2090	2600	3200	3930	4810	5900	7110						
	20	0	0	410*	650	1030	1610	2000	2470	3040	3730	4580	5530						
	25	0	0	0	530*	830	1300	1620	1990	2450	3010	3700	4470	5430					
	30	0	0	0	430*	680	1070	1330	1640	2030	2490	3060	3700	4500	5130	5860			
	40	0	0	0	0	500*	790	980	1210	1490	1830	2250	2710	3290	3730	4250			
	50	0	0	0	0	0	640*	800	980	1210	1480	1810	2190	2650	3010	3420	3830	4180	4850
	60	0	0	0	0	0	540*	670*	830*	1020	1250	1540	1850	2240	2540	2890	3240	3540	4100
	75	0	0	0	0	0	0	0	680*	840*	1030	1260	1520	1850	2100	2400	2700	2950	3440
	100	0	0	0	0	0	0	0	0	620*	760*	940*	1130	1380	1560	1790	2010	2190	2550
	125	0	0	0	0	0	0	0	0	0	0	740*	890*	1000*	1220	1390	1560	1700	1960
	150	0	0	0	0	0	0	0	0	0	0	0	760*	920*	1050*	1190*	1340	1460	1690
	175	0	0	0	0	0	0	0	0	0	0	0	0	810*	930*	1060*	1190*	1300	1510
	200	0	0	0	0	0	0	0	0	0	0	0	0	0	810*	920*	1030*	1130*	1310
575V 60Hz Three Phase Three Wire	1/2	5900	9410																
	3/4	4270	6810																
	1	3630	5800	9120															
	1 1/2	2620	4180	6580															
	2	2030	3250	5110	8060														
	3	1580	2530	3980	6270														
	5	920	1480	2330	3680	5750													
	7 1/2	660	1060	1680	2650	4150													
	10	490	780	1240	1950	3060	4770	5940											
	15	330*	530	850	1340	2090	3260	4060											
	20	0	410*	650	1030	1610	2520	3140	3860	4760	5830								
	25	0	0	520*	830	1300	2030	2530	3110	3840	4710								
	30	0	0	430*	680	1070	1670	2080	2560	3160	3880	4770	5780	7030	8000				
	40	0	0	0	500*	790	1240	1540	1900	2330	2860	3510	4230	5140	5830				
460V-60Hz Three Phase Six Wire	150	0	0	0	0	0	0	0	510*	630*	770*	950	1140	1380	1570	1790	2000	2180	2530
	175	0	0	0	0	0	0	0	0	550*	680*	830*	1000	1220	1390	1580	1780	1950	2270
	200	0	0	0	0	0	0	0	0	590*	730*	880*	1070	1210	1380	1550	1690	1970	
575V-60Hz Three Phase Six Wire	150	0	0	0	0	0	0	650*	800*	990*	1210	1480	1780	2160	2450	2790	3120	3410	3950
	175	0	0	0	0	0	0	0	700*	860*	1060	1300	1570	1910	2170	2480	2780	3040	3540
	200	0	0	0	0	0	0	0	760*	930*	1140	1370	1670	1890	2160	2420	2640	3070	

See page 10 for additional footnotes.

The portion of the total cable between the service entrance and a 3Ø motor starter should not exceed 25% of the total maximum length to assure reliable started operation.

Application Three Phase Motors

Table 12 Three Phase Motor Specifications (60 Hertz)

Motor Model Prefix					Rated Input		Maximum (S.F. Load)		Line to Line Res.	Efficiency %			Power Factor %			Locked Rotor Amps	KVA Code	Circuit Breaker or Fuse AMPS	
	HP	Volts	HZ	S.F.	Amps	Watts	Amps	Watts		S.F.	F.L.	3/4	S.F.	F.L.	3/4			Std.	Delay

4 Inch - 3450 RPM

234501	1/2	200	60	1.6	2.8	585	3.4	860	6.64-7.3	69.5	63.7	58.2	75.8	61.0	52.5	17.3	N	10	5
234511	1/2	230	60	1.6	2.4	585	2.9	860	9.5-10.4	69.5	63.7	58.2	75.8	61.0	52.5	15.0	N	8	4
234521	1/2	460	60	1.6	1.2	585	1.5	860	38.4-41.6	69.5	63.7	58.2	75.8	61.0	52.5	7.5	N	4	2
234502	3/4	200	60	1.5	3.6	810	4.4	1150	4.66-5.12	73.2	69.2	64.6	78.2	66.0	57.2	24.6	N	12	6
234512	3/4	230	60	1.5	3.1	810	3.8	1150	7.24-7.84	73.2	69.2	64.6	78.2	66.0	57.2	21.4	N	11	5
234522	3/4	460	60	1.5	1.6	810	1.9	1150	27.8-30.2	73.2	69.2	64.6	78.2	66.0	57.2	10.7	N	5	3
234503	1	200	60	1.4	4.5	1070	5.4	1440	4.1-4.5	72.5	70.0	66.0	79.4	69.1	60.0	31.0	M	15	6
234513	1	230	60	1.4	3.9	1070	4.7	1440	5.2-5.6	72.5	70.0	66.0	79.4	69.0	60.0	27.0	M	12	6
234523	1	460	60	1.4	2.0	1070	2.4	1440	21.2-23.0	72.5	70.0	66.0	79.4	69.0	60.0	13.5	M	6	3
234504	1 1/2	200	60	1.3	5.8	1460	6.8	1890	2.5-3.0	77.0	76.4	74.1	81.6	73.4	63.7	38.1	K	20	8
234514	1 1/2	230	60	1.3	5.0	1460	5.9	1890	3.2-4.0	77.0	76.4	74.1	81.6	73.4	63.7	33.1	K	15	7
234524	1 1/2	460	60	1.3	2.5	1460	3.0	1890	13.0-16.0	77.0	76.4	74.1	81.6	73.4	63.7	16.6	K	8	4
234534	1 1/2	575	60	1.3	2.0	1460	2.4	1890	20.3-25.0	77.0	76.4	74.1	81.6	73.4	63.7	13.2	K	6	3
234305	2	200	60	1.25	7.7	2150	9.3	2700	1.9-2.4	69.5	69.5	67.4	84.4	79.0	71.2	53.6	L	25	10
234315	2	230	60	1.25	6.7	2150	8.1	2700	2.4-3.0	69.5	69.5	67.4	84.4	79.0	71.2	46.6	L	20	10
234325	2	460	60	1.25	3.4	2150	4.1	2700	9.7-12.0	69.5	69.5	67.4	84.4	79.0	71.2	23.3	L	15	5
234335	2	575	60	1.25	2.7	2150	3.2	2700	15.1-18.7	69.5	69.5	67.4	84.4	79.0	71.2	18.6	L	15	4
234306	3	200	60	1.15	10.9	2980	12.5	3420	1.3-1.7	75.5	75.2	73.2	81.5	77.8	69.5	71	K	35	15
234316	3	230	60	1.15	9.5	2980	10.9	3420	1.8-2.2	75.5	75.2	73.2	81.5	77.8	69.5	62	K	30	12
234326	3	460	60	1.15	4.8	2980	5.5	3420	7.0-8.7	75.5	75.2	73.2	81.5	77.8	69.5	31	K	15	6
234336	3	575	60	1.15	3.8	2980	4.4	3420	10.9-13.6	75.5	75.2	73.2	81.5	77.8	69.5	25	K	12	5
234307	5	200	60	1.15	18.3	5050	20.5	5810	.70-.94	74.0	74.0	72.2	84.0	81.0	73.0	122	K	50	25
234317	5	230	60	1.15	15.9	5050	17.8	5810	.93-1.2	74.0	74.0	72.2	84.0	81.0	73.0	106	K	45	20
234327	5	460	60	1.15	8.0	5050	8.9	5810	3.6-4.4	74.0	74.0	72.2	84.0	81.0	73.0	53	K	25	10
234337	5	575	60	1.15	6.4	5050	7.1	5810	5.6-6.9	74.0	74.0	72.2	84.0	81.0	73.0	43	K	20	8
234308	7 1/2	200	60	1.15	26.5	7360	30.5	8450	.46-.57	76.2	76.0	74.0	83.2	80.0	72.2	188	K	80	35
234318	7 1/2	230	60	1.15	23.0	7360	26.4	8450	.61-.75	76.2	76.0	74.0	83.2	80.0	72.2	164	K	70	30
234328	7 1/2	460	60	1.15	11.5	7360	13.2	8450	2.4-3.4	76.2	76.0	74.0	83.2	80.0	72.2	82	K	35	15
234338	7 1/2	575	60	1.15	9.2	7360	10.6	8450	3.5-5.1	76.2	76.0	74.0	83.2	80.0	72.2	65	K	30	12
234329	10	460	60	1.15	17.0	10000	18.8	11400	1.8-2.3	75.2	74.5	72.0	79.2	75.5	67.1	116	K	50	25
234339	10	575	60	1.15	13.6	10000	15.0	11400	2.8-3.5	75.2	74.5	72.0	79.2	75.5	67.1	93	K	40	20

6 Inch - 3450 RPM

236650	5	200	60	1.15	17.5	4700	19.1	5400	.68-.84	79.5	79.1	77.2	82.0	79.5	73.8	99	H	50	25
236600	5	230	60	1.15	15.0	4700	16.6	5400	.88-1.09	79.5	79.1	77.2	82.0	79.5	73.8	86	H	45	20
236610	5	460	60	1.15	7.5	4700	8.3	5400	3.53-4.37	79.5	79.1	77.2	82.0	79.5	73.8	43	H	25	10
236620	5	575	60	1.15	6.0	4700	6.6	5400	5.93-7.16	79.5	79.1	77.2	82.0	79.5	73.8	34	H	20	8
236651	7 1/2	200	60	1.15	25.1	7000	28.3	8000	.39-.48	79.8	80.0	78.7	83.0	80.5	73.8	150	H	70	30
236601	7 1/2	230	60	1.15	21.8	7000	24.6	8000	.57-.71	79.8	80.0	78.7	83.0	80.5	73.8	130	H	70	30
236611	7 1/2	460	60	1.15	10.9	7000	12.3	8000	2.17-2.68	79.8	80.0	78.7	83.0	80.5	73.8	65	H	30	15
236621	7 1/2	575	60	1.15	8.7	7000	9.8	8000	3.65-4.41	79.8	80.0	78.7	83.0	80.5	73.8	52	H	25	12
236652	10	200	60	1.15	32.7	9400	37	10800	.33-.42	79.2	79.4	78.0	85.5	83.2	77.2	198	H	100	40
236602	10	230	60	1.15	28.4	9400	32.2	10800	.44-.55	79.2	79.4	78.0	85.5	83.2	77.2	172	H	80	35
236612	10	460	60	1.15	14.2	9400	16.1	10800	1.76-2.17	79.2	79.4	78.0	85.5	83.2	77.2	86	H	40	20
236622	10	575	60	1.15	11.4	9400	12.9	10800	2.87-3.47	79.2	79.4	78.0	85.5	83.2	77.2	69	H	35	15

Table 13 Three Phase Motor Specifications (60 Hertz)

Motor Model					Rated Input		Maximum (S.F. Load)		Line to Line Res.	Efficiency %			Power Factor %			Locked Rotor	KVA	Circuit Breaker	
	HP	Volts	HZ	S.F.	Amps	Watts	Amps	Watts		S.F.	F.L.	3/4	S.F.	F.L.	3/4	Amps	Code	Std.	Delay

6 Inch Con't - 3450 RPM

236653	15	200	60	1.15	47.8	13700	54.5	15800	.22-.27	81.0	81.5	80.2	84.9	82.8	76.5	306	H	150	60
236603	15	230	60	1.15	41.6	13700	47.4	15800	.27-.33	81.0	81.5	80.2	84.9	82.8	76.5	266	H	125	60
236613	15	460	60	1.15	20.8	13700	23.7	15800	1.07-1.32	81.0	81.5	80.2	84.9	82.8	76.5	133	H	60	30
236623	15	575	60	1.15	16.7	13700	19	15800	1.70-2.10	81.0	81.5	80.2	84.9	82.8	76.5	106	H	50	25
236654	20	200	60	1.15	61.9	18100	69.7	20900	.14-.17	82.0	82.3	81.6	86.8	84.8	79.5	416	J	200	80
236604	20	230	60	1.15	53.8	18100	60.6	20900	.20-.25	82.0	82.3	81.6	86.8	84.8	79.5	362	J	175	70
236614	20	460	60	1.15	26.9	18100	30.3	20900	.76-.94	82.0	82.3	81.6	86.8	84.8	79.5	181	J	80	35
236624	20	575	60	1.15	21.5	18100	24.4	20900	1.22-1.52	82.0	82.3	81.6	86.8	84.8	79.5	145	J	70	30
236655	25	200	60	1.15	77.1	22500	86.3	25700	.11-.14	82.8	83.0	82.0	87.0	85.0	79.2	552	J	225	100
236605	25	230	60	1.15	67	22500	75	25700	.15-.19	82.8	83.0	82.0	87.0	85.0	79.2	480	J	200	90
236615	25	460	60	1.15	33.5	22500	37.5	25700	.59-.73	82.8	83.0	82.0	87.0	85.0	79.2	240	J	100	45
236625	25	575	60	1.15	26.8	22500	30	25700	1.01-1.25	82.8	83.0	82.0	87.0	85.0	79.2	192	J	80	35
236656	30	200	60	1.15	90.9	26900	104	31100	.10-.12	82.5	83.0	82.6	87.5	85.4	80.3	653	J	300	125
236606	30	230	60	1.15	79	26900	90.4	31100	.12-.15	82.5	83.0	82.6	87.5	85.4	80.3	568	J	250	110
236616	30	460	60	1.15	39.5	26900	45.2	31100	.48-.60	82.5	83.0	82.6	87.5	85.4	80.3	284	J	125	50
236626	30	575	60	1.15	31.6	26900	36.2	31100	.78-.95	82.5	83.0	82.6	87.5	85.4	80.3	227	J	100	40
236617	40	460	60	1.15	53.5	35600	62	42400	.32-.40	83.2	83.4	82.9	85.8	83.6	77.6	397	J	150	70
236627	40	575	60	1.15	42.8	35600	49.6	42400	.53-.59	83.2	83.4	82.9	85.8	83.6	77.6	318	J	125	60
236618	50	460	60	1.15	67.7	45100	77	52200	.25-.32	82.5	83.0	82.7	85.2	84.0	80.0	414	H	200	90
236628	50	575	60	1.15	54.2	45100	61.6	52200	.39-.48	82.5	83.0	82.7	85.2	84.0	80.0	331	H	150	70
236619	60	460	60	1.15	80.5	53500	91	61700	.22-.27	84.2	84.5	84.0	85.0	83.3	78.0	518	H	250	100
236629	60	575	60	1.15	64.4	53500	72.8	61700	.35-.39	84.2	84.5	84.0	85.0	83.3	78.0	414	H	200	80

8 Inch - 3525 RPM

239600	40	460	60	1.15	53	35000	60	40000	.256-.283	86.2	86.1	84.8	86.1	84.2	78.5	407	K	175	70
239610	40	575	60	1.15	42	35000	48	40000	.412-.456	86.0	85.9	84.6	86.0	85.0	81.0	326	K	125	60
239601	50	460	60	1.15	65	43000	73	49000	.188-.207	87.3	87.2	86.2	86.6	85.5	80.5	528	K	200	80
239611	50	575	60	1.15	53	43000	60	49000	.290-.320	86.6	86.5	85.2	87.0	86.0	86.0	422	K	150	70
239602	60	460	60	1.15	79	52000	89	60000	.148-.163	87.6	87.5	87.2	87.6	85.9	81.3	658	K	225	100
239612	60	575	60	1.15	61	52000	69	60000	.235-.260	87.3	87.2	86.1	86.0	85.0	80.0	526	K	175	80
239603	75	460	60	1.15	97	64000	107	73500	.110-.121	88.1	88.0	86.8	88.0	86.8	82.0	833	K	300	125
239613	75	575	60	1.15	78	64000	85	73500	.175-.193	87.5	87.4	86.2	86.0	85.0	81.0	666	K	225	100
239604	100	460	60	1.15	125	85000	144	97500	.076-.084	88.3	88.1	87.5	88.1	86.6	81.7	1212	L	400	175
239614	100	575	60	1.15	104	85000	116	97500	.114-.126	88.0	87.8	86.4	85.8	84.0	79.0	970	L	300	150
239105	125	460	60	1.15	165	109000	189	125000	.057-.063	87.3	86.9	85.3	87.2	86.9	77.9	1318	K	500	225
239115	125	575	60	1.15	136	109000	150	125000	.090-.100	87.2	86.9	85.3	84.3	82.6	77.5	1054	K	400	175
239106	150	460	60	1.15	193	128000	221	146000	.049-.054	87.7	87.4	86.0	86.0	84.4	79.7	1620	K	600	250
239116	150	575	60	1.15	154	128000	177	146000	.067-.074	87.9	87.4	85.7	82.9	80.8	75.0	1296	K	450	200
239107	175	460	60	1.15	218	150000	250	173000	.045-.050	87.3	87.0	86.7	88.8	87.6	84.8	1645	J	700	300
239117	175	575	60	1.15	174	150000	200	173000	.067-.074	88.5	88.0	86.1	86.2	85.0	80.0	1316	J	700	300
239108	200	460	60	1.15	245	169000	286	194000	.038-.042	88.0	87.9	86.8	88.7	88.4	84.5	1875	J	800	350
239118	200	575	60	1.15	196	169000	229	194000	.060-.066	88.0	88.0	87.0	89.5	88.6	85.3	1500	J	600	300

Model numbers are three lead motors. Six lead motors with different model numbers have the same running performance, but when we connected for starting have locked rotor amps 33% of the values shown. Six lead individual phase resistance = table \times 1.5.

Overload Protection Of Three Phase Submersible Motors

The characteristics of submersible motors are different from standard motors and special overload protection is required. If the motor is stalled, the overload protector must trip within 10 seconds to protect the motor windings. The installer must use SUBTROL or the quick-trip protection shown in these tables. All recommended overload selections are of the ambient compensated type to maintain protection at high and low air temperatures.

All heaters and amp settings shown are based on total line amps. When a six-lead motor is used with a Wye-Delta starter, heaters carrying phase amps must be selected or adjusted based on motor amps divided by 1.732.

The tables below list the correct selection and settings for several manufacturers. Approval of other types may be requested.

Refer To Notes On Page 17.

Table 14 60 Hertz 4" Motors

HP	Volts	NEMA Starter Size	Heaters For Overload Relays			Adjustable Relays See (Note 4)	
			Furnas (Note 1)	Allen Bradley (Note 2)	G.E. (Note 3)	Set	Max.
1/2	200	00	K31	J16	L380A	3.2	3.4
	230	00	K28	J14	L343A	2.7	2.9
	460	00	—	J8	L174A	1.4	1.5
	575	00	—	J6	—	1.2	1.3
3/4	200	00	K34	J19	L510A	4.1	4.4
	230	00	K32	J17	L420A	3.5	3.8
	460	00	K23	J10	L211A	1.8	1.9
	575	00	K21	J8	L193A	1.5	1.6
1	200	00	K37	J21	L618A	5.0	5.4
	230	00	K36	J19	L561A	4.4	4.7
	460	00	K26	J12	L282A	2.2	2.4
	575	00	K23	J10	L211A	1.8	1.9
1 1/2	200	00	K42	J23	L750A	6.3	6.8
	230	00	K39	J21	L680A	5.5	5.9
	460	00	K29	J15	L343A	2.8	3.0
	575	00	K26	J12	L282A	2.2	2.4
2	200	0	K50	J26	L111B	8.6	9.3
	230	0	K49	J25	L910A	7.5	8.1
	460	00	K33	J18	L463A	3.8	4.1
	575	00	K29	J15	L380A	3.0	3.2
3	200	0	K55	J29	L147B	11.6	12.5
	230	0	K52	J28	L122B	10.1	10.9
	460	0	K37	J21	L618A	5.1	5.5
	575	0	K34	J19	L510A	4.1	4.4
5	200	1	K62	J34	L241B	19.1	20.5
	230	1	K61	J33	L199B	16.6	17.8
	460	0	K49	J26	L100B	8.3	8.9
	575	0	K42	J23	L825A	6.6	7.1
7 1/2	200	1	K68	J38	L322B	28.4	30.5
	230	1	K67	J37	L293B	24.6	26.4
	460	1	K55	J30	L147B	12.3	13.2
	575	1	K52	J28	L122B	9.9	10.6
10	460	1	K61	J33	L220B	17.5	18.8
	575	1	K57	J31	L181B	14.0	15.0

Table 15 60 Hertz 6" Motors

HP	Volts	NEMA Starter Size	Heaters For Overload Relays			Adjustable Relays (Note 4)	
			Furnas (Note 1)	Allen Bradley (Note 2)	G.E. (Note 3)	Set	Max.
5	200	1	K61	J33	L220B	17.8	19.1
	230	1	K60	J32	L199B	15.4	16.6
	460	0	K49	J25	L910B	7.7	8.3
	575	0	K41	J23	L750A	6.1	6.6
7 1/2	200	1	K67	J38	L322B	26.3	28.3
	230	1	K64	J36	L293B	22.9	24.6
	460	1	K54	J29	L147B	11.4	12.3
	575	1	K52	J27	L111B	9.1	9.8
10	200	2(1)	K72	J40	L426B	34.4	37.0
	230	2(1)	K70	J38	L390B	29.9	32.2
	460	1	K58	J32	L181B	15.0	16.1
	575	1	K55	J30	L147B	12.0	12.9
15	200	3(1)	K76	J43	L650B	50.7	54.5
	230	2	K75	J42	L520B	44.1	47.4
	460	2(1)	K64	J35	L265B	22.0	23.7
	575	2(1)	K61	J33	L220B	17.7	19.0
20	200	3	K78	J45	L787B	64.8	69.7
	230	3	K78	J44	L710B	56.4	60.6
	460	2	K69	J38	L352B	28.2	30.3
	575	2	K64	J35	L293B	22.7	24.4
25	200	3	K86	J71	L107C	80.3	86.3
	230	3	K83	J46	L866B	69.8	75.0
	460	2	K72	J40	L426B	34.9	37.5
	575	2	K69	J37	L352B	27.9	30.0
30	200	4(1)	K88	J72	L126C	96.7	104.0
	230	3	K87	J71	L107C	84.1	90.4
	460	3(1)	K74	J41	L520B	42.0	45.2
	575	3(1)	K72	J39	L390B	33.7	36.2
40	460	3	K77	J44	L710B	57.7	62.0
	575	3	K74	J42	L593B	46.1	49.6
50	460	3	K83	J46	L950B	71.6	77.0
	575	3	K77	J44	L710B	57.3	61.6
60	460	4(1)	K87	J71	L107C	84.6	91.0
	575	4(1)	K78	J45	L866B	67.7	72.8

Table 16 60 Hertz 8" Motors

HP	Volts	NEMA Starter Size	Heaters For Overload Relays			Adjustable Relays (Note 4)	
			Furnas (Note 1)	Allen Bradley (Note 2)	G.E. (Note 3)	Set	Max.
40	460	3	K77	J43	L710B	56	60
	575	3	K73	J41	L520B	45	48
50	460	3	K78	J46	L866B	68	73
	575	3	K77	J43	L710B	56	60
60	460	4(1)	K86	J70	L107C	83	89
	575	4(1)	K78	J44	L787B	64	69
75	460	4(1)	K89	J72	L126C	100	107
	575	4(1)	K85	J70	L950B	79	85
100	460(5)	4	K92	J76	L155C	134	144
	575	4	K90	J73	L142C	108	116
125	460(5)	5(1)	K29	J15	L111B	176	189
	575(5)	5(1)	K26	J13	L825A	140	150
150	460(5)	5	K32	J17	L122B	206	221
	575(5)	5(1)	K28	J14	L100B	165	177
175	460(5)	5	K33	J18	L147B	233	250
	575(5)	5	K31	J16	L111B	186	200
200	460(5)	5	K33	J20	L165B	266	286
	575(5)	5	K32	J17	L135B	213	229

Notice: Warranty on three phase submersible motors is void unless Subtrol or proper quick trip ambient compensated protection is used in all three motor lines.

Overload Protection Of Three Phase Submersible Motors

Notes for Overload Protection Tables (Page 16)

Footnotes:

Note 1: Furnas intermediate sizes between NEMA starter sizes apply where (1) is shown in tables, size 1-3/4 replacing 2, 2-1/2 replacing 3, 3-1/2 replacing 4, and 4-1/2 replacing 5. Heaters were selected from Catalog 294, Table 332 and Table 632 (starter size 00, size B). Size 4 starters are heater type 4(JG). Starters using these heater tables include classes 14, 17 and 18 (INNOVA), classes 36 and 37 (reduced voltage), and classes 87, 88 and 89 (pump and motor control centers). Overload relay adjustments should be set no higher than 100% unless necessary to stop nuisance tripping with measured amps in all lines below nameplate maximum. Heater selections for class 16 starters (Magnetic Definite Purpose) will be furnished upon request.

Note 2: Allen-Bradley heaters were selected from Catalog IC-110, Table 162 (through starter size 4), Table 547 (starter size 5), and Table 196 (starter size 6). Bulletin 505, 509, 520, 540 and 570 use these heater tables. Heater selections for bulletin 1232X and 1233X starters will be furnished upon request.

Note 3: General Electric heaters are type CR123 usable only on type CR124 overload relays and were selected from Catalog GEP-1260J, page 184. Adjustment should be set no higher than 100%, unless necessary to stop nuisance tripping with measured amps in all lines below nameplate maximum.

Note 4: Adjustable overload relay amp settings apply to approved types listed. Relay adjustment should be set at the specified SET amps. Only if tripping occurs with amps in all lines measured to be within nameplate maximum amps should the setting be increased, not to exceed the MAX value shown.

Note 5: Heaters shown for ratings requiring NEMA size 5 or 6 starters are all used with current transformers per manufacturer standards. Adjustable relays may or may not use current transformers depending on design.

Some approved types may only be available for part of the listed motor ratings. When relays are used with current transformers, relay setting is the specified amps divided by the transformer ratio.

Approved Adjustable Overload Relays

AEG Series: B17S, B27S, B27-2

ABB Type: RVH 40, RVH65, RVP160, T25DU, T25CT

Allen Bradley: Bulletin 193, SMP-Class 10 only.

Cutler-Hammer C316F, C316P, C316S, C310-set at 6 seconds max.

Fanal Types: K7 or K7D through K400

Fuji Types: TR-OQ, TR-OQH, TR-2NQ, TR-3NQ, TR-4NQ,

TR-6NQ, RCa 3737-1CQ & 1CQH

Furnas Types: US15 48AG & 48BG, ESP100-Class 10 only

General Electric CR4G, CR7G, RT*1, RT*2, RT*4, CR324X-Class 10 only.

Klockner-Moeller Types: ZOO, ZI, Z4, PKZM1, PKZM3 & PKZ2

Lovato RC9, RC22, RC80, RF9, RF25 & RF95

Asco-Delta Types: DQ, LR1-D, LR1-F & LR2-D13, -D23, -D33

Sprecher and Schuh Types: CT, CT1, CTA 1, CT3K, CT3-12 thru

CT3-42, KTA3, CEF1- set at 8 seconds max.

Siemens Types: 3UA50, -52, -54, -55, -58, -59, -60, -61, -62, -68, -70, 3VUI3, 3VE

Square D /Telemecanique CLASS 9065 Types TD, TE, TF, TG, TJ, TK, TR

and TJE, or LR1-D, LR1-F, LR2-D13, -D23, -D33. Types 18A, 32A,

SS-CLASS 10, SR-CLASS 10 and 63A-LB1Series. Integral 18, 32, 63, GV2-L, GV2-M, GV2-P, GV3-M.

Toshiba Type 2E RC820, set at 8 seconds max.

Westinghouse Types: FT13, FT23, FT33, FT43, K7D, K27D, K67D & MOR

Westmaster: OLWROO and OLWTOO suffix D thru P

Other relay types from these and other manufacturers may or may not provide acceptable protection, and they should not be used without approval of Franklin Electric.

Notice: Warranty on three phase submersible motors is void unless Subtrol or proper quick trip ambient compensated protection is used on all three motor lines.

Power Factor Correction

In some installations, power supply limitations make it necessary or desirable to increase the power factor of a submersible motor. The table lists the capacitive KVAR required to increase the power factor of large Franklin three phase submersible motors to the approximate values shown at maximum input loading.

Capacitors must be connected on the line side of the overload relay, or overload protection will be lost.

Table 17 KVAR Required

Motor HP	Hertz	Motor P.F.	Required KVAR for P.F. of:		
			.90	.95	1.00
5	60	.82	1.2	2.1	4
7 1/2	60	.83	1.7	3.1	6
10	60	.85	1.5	3.3	7
15	60	.85	2.2	4.7	10
20	60	.87	1.7	5.0	12
25	60	.87	2.1	6.2	15
30	60	.87	2.5	7.4	18
40	60	.86	4.5	11	24
50	60	.85	7.1	15	32
60	60	.85	8.4	18	38
75	60	.87	6.3	18	43
100	60	.86	11	27	60
125	60	.85	17	36	77
150	60	.85	20	42	90
175	60	.88	9.6	36	93
200	60	.87	16	46	110

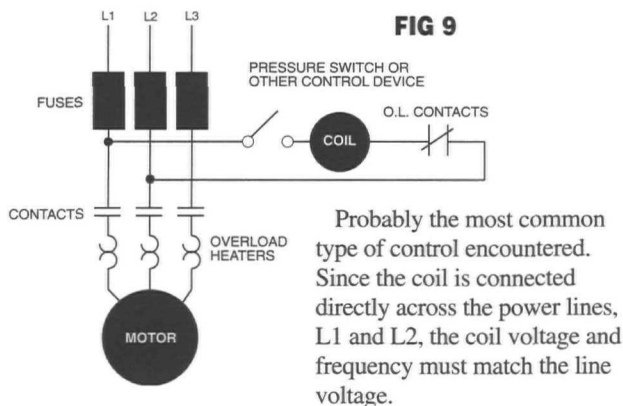
Three Phase Starter Diagrams

Three phase combination magnetic starters have two distinct circuits, a power circuit and a control circuit.

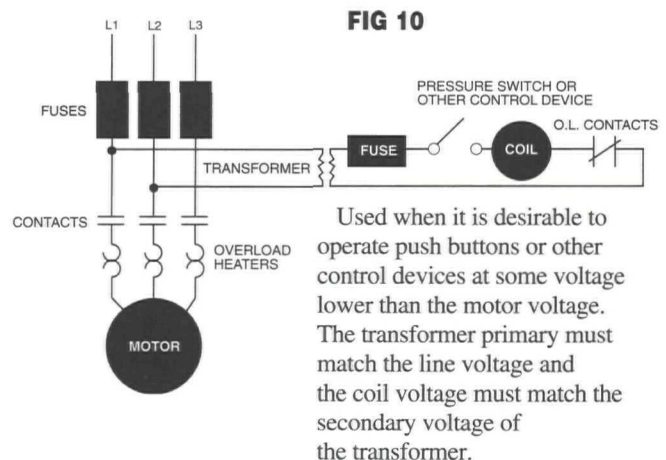
The power circuit consists of a circuit breaker or fused line switch, contacts, and overload heaters connecting incoming power lines, L1, L2, L3 and the three phase motor.

The control circuit consists of the magnetic coil, overload contacts and a control device such as a pressure switch. When the control device contacts are closed, current flows through the magnetic contactor coil, the contacts close, and power is applied to the motor. Hand-Off-Auto switches, start timers, level controls and other control devices may also be wired in series in the control circuit.

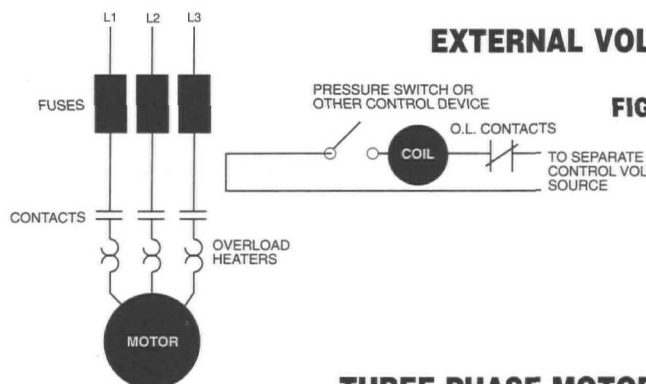
LINE VOLTAGE CONTROL



LOW VOLTAGE TRANSFORMER CONTROL

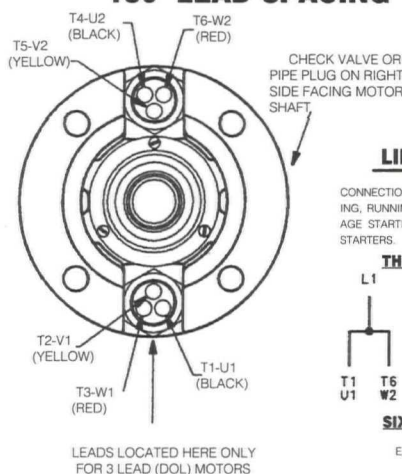


EXTERNAL VOLTAGE CONTROL



THREE PHASE MOTOR LEAD IDENTIFICATION

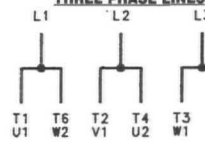
180° LEAD SPACING



LINE CONNECTIONS - SIX LEAD MOTORS

CONNECTION FOR ACROSS-THE-LINE STARTING, RUNNING, AND ANY REDUCED VOLTAGE STARTING EXCEPT WYE-DELTA TYPE STARTERS.

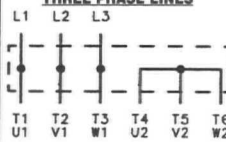
THREE PHASE LINES



SIX MOTOR LEADS

WYE DELTA STARTERS CONNECT THE MOTOR AS SHOWN BELOW DURING STARTING, THEN CHANGE TO THE RUNNING CONNECTION SHOWN AT THE LEFT.

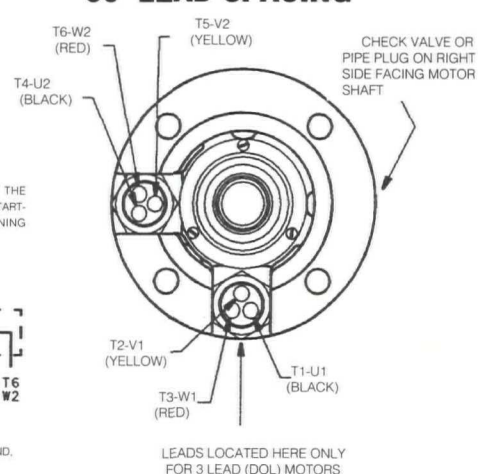
THREE PHASE LINES



SIX MOTOR LEADS

EACH MOTOR LEAD IS NUMBERED WITH TWO MARKERS ONE NEAR EACH END. TO REVERSE ROTATION: INTERCHANGE ANY TWO LINE CONNECTIONS.

90° LEAD SPACING



Three Phase Power Unbalance

A full three phase supply is recommended for all three phase motors, consisting of three individual transformers or one three phase transformer. So-called "open" delta or wye connections using only two transformers can be used, but are more likely to cause problems, such as poor performance overload tripping or early motor failure due to current unbalance.

Transformer ratings should be no smaller than listed in Table 2 on page 3 for supply power to the motor alone.

Phase designation of leads for CCW rotation viewing shaft end.

To reverse rotation, interchange any two leads.

Phase 1 or "A" – Black Motor Lead or T1
Phase 2 or "B" – Yellow Motor Lead or T2
Phase 3 or "C" – Red Motor Lead or T3

NOTICE: Phase 1, 2 and 3 may not be L1, L2 and L3.

Checking and correcting rotation and current unbalance

1. Establish correct motor rotation by running in both directions. Change rotation by exchanging any two of the three motor leads. The rotation that gives the most water flow is always the correct rotation.

2. After correct rotation has been established, check the current in each of the three motor leads and calculate the current unbalance as explained in 3 below.

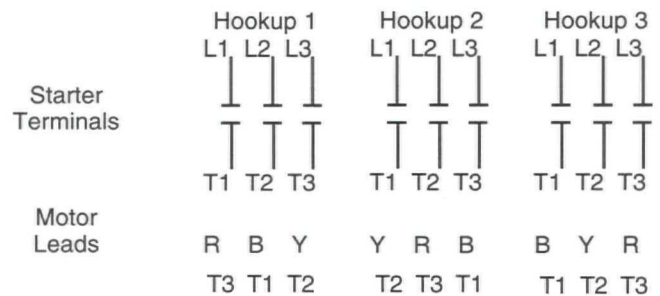
If the current unbalance is 2% or less, leave the leads as connected.

If the current unbalance is more than 2%, current readings should be checked on each leg using each of the three possible hook-ups. Roll the motor leads across the starter in the same direction to prevent motor reversal.

3. To calculate percent of current unbalance:

- Add the three line amp values together.
- Divide the sum by three, yielding average current.
- Pick the amp value which is furthest from the average current (either high or low).
- Determine the difference between this amp value (furthest from average) and the average.
- Divide the difference by the average.
Multiply the result by 100 to determine percent of unbalance.

4. Current unbalance should not exceed 5% at service factor load or 10% at rated input load. If the unbalance cannot be corrected by rolling leads, the source of the unbalance must be located and corrected. If, on the three possible hookups, the leg farthest from the average stays on the same power lead, most of the unbalance is coming from the power source. However, if the reading farthest from average moves with the same motor lead, the primary source of unbalance is on the "motor side" of the starter. In this instance, consider a damaged cable, leaking splice, poor connection, or faulty motor winding.



Example:

T3-R = 51 amps	T2-Y = 50 amps	T1-B = 50 amps
T1-B = 46 amps	T3-R = 48 amps	T2-Y = 49 amps
T2-Y = 53 amps	T1-B = 52 amps	T3-R = 51 amps
Total = 150 amps	Total = 150 amps	Total = 150 amps
÷ 3 = 50 amps	÷ 3 = 50 amps	÷ 3 = 50 amps
— 46 = 4 amps	— 48 = 2 amps	— 49 = 1 amp
4 ÷ 50 = .08 or 8%	2 ÷ 50 = .04 or 4%	1 ÷ 50 = .02 or 2%

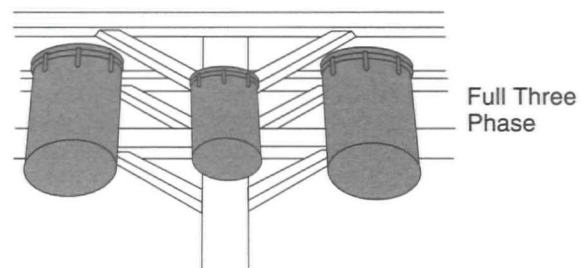
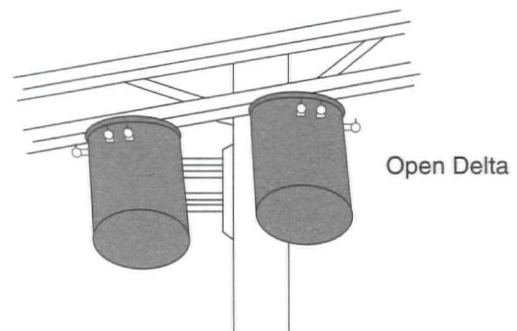


FIG 12

Phase Converters

THE WARRANTY ON ALL FRANKLIN THREE PHASE SUBMERSIBLE MOTORS IS VOID IF OPERATED FROM SINGLE PHASE POWER THROUGH A PHASE CONVERTER UNLESS APPROVAL OF THE SYSTEM (IN WRITING) HAS BEEN OBTAINED FROM THE FRANKLIN ELECTRIC FIELD SERVICE DEPARTMENT.

There are a number of types of phase converters available. Each is intended to allow the use of a three phase motor on a single phase power line. Some of these designs present problems which can lead to motor failure.

Phase converters, with the exception of solid state models, create a "manufactured voltage" leg by the use of capacitors, winding taps or adjustable relays. In all of these arrangements, the voltage balance is critical to the current balance. Some phase converters may be well balanced at one point on the system operating curve. Submersible pumping systems often operate at differing points on the curve as water levels and operating pressures fluctuate. Other converters may be well balanced at varying loads, but their output may vary widely with fluctuations in the input voltage.

The following guidelines have been established for submersible installations to be warrantable when used with a phase converter.

1. Limit pump loading to rated horsepower. Do not load into motor service factor.
2. Maintain at least three feet per second motor cooling. Use a flow sleeve when necessary.
3. Use time delay fuses or circuit breakers in pump panel. Standard fuses or circuit breakers do not provide secondary motor protection.
4. Subtrol Plus may be used on electro mechanical type phase converters, however special connections are required. Consult Subtrol Plus Manual for connections of receiver and lightning arrestor.
5. Subtrol Plus will not work with electronic solid state phase converters.
6. Current unbalance must not exceed 10% under varying load conditions.
7. Report system parameters on Form 2207, Submersible Motor Installation Record. Send to:

Franklin Electric
400 E. Spring Street
Bluffton, IN 46714
Attention: Field Service Department

Upon receipt and analysis of the data and installation details supplied on Form No. 2207, Franklin engineers will advise by letter if the installation will be covered by Franklin's warranty.

Reduced Voltage Starters

All Franklin three phase submersible motors are suitable for full voltage starting. Under this condition the motor speed goes from zero to full speed within one half second or less. The load current goes from zero to locked rotor amps, about 5 to 7 times running amps, and drops to running amps at full speed. This may dim lights, cause momentary voltage dips to other electrical equipment and shock load power distribution transformers.

Power companies often require soft starters or limit motor KVA load that may be started "directly on line". There are also times when it may be desirable to reduce motor starting torque. This lessens the stress on shafts, couplings, and castings as well as the supporting discharge piping. A "strong" voltage supply and very little cable voltage drop produces high starting torque. In other words, this is an installation that is electrically and mechanically "stiff". Reduced voltage starters are often used to reduce starting KVA or torque, and sometimes to slow the immediate acceleration of the water on start up to control upthrust and waterhammer.

With maximum recommended cable length where there is a 5% voltage drop in the cable, there will be about 20% reduced starting current and about 36% reduced starting torque compared to having rated voltage at the motor. On some installations this may be enough reduction in starting current so that reduced voltage starters may not be required.

Standard 3 Ø motors have three line leads so only resistance, autotransformers, or solid state reduced voltage starters may be used. The autotransformer type is preferred over resistance and solid state types because it draws lower line current for the same starting torque. Wye-Delta starters are used with six lead Wye-Delta motors. All Franklin 6" and 8" three phase motors are available in six lead Wye-Delta construction. Consult the factory for details and availability. Part winding starters are not usable with Franklin Electric submersible motors.

When reduced voltage starters are used it is recommended the motor be supplied with at least 55% of rated voltage to ensure adequate starting torque.

Most autotransformer starters have 65% and 85% taps. Setting the taps on these starters depends on the percentage of the maximum allowable cable length used in the system. If the cable length is less than 50% of the maximum allowable, either the 65% or 80% taps may be used. When the cable length is more than 50% of the allowable, the 80% tap should be used.

Solid state reduced voltage starters may be used with submersibles, but may not be usable with Subtrol-Plus. Consult the factory.

Both electromechanical and solid state starters have adjustable time delays for starting. Typically they are preset at 30 seconds. They must be set so the motor is at full voltage within two to three seconds maximum to prevent overload trip and unnecessary motor heating.

Open transition starters, which momentarily interrupt power during the starting cycle, are not recommended. Should the motor/pump rotating parts be passing through their critical speed, as low voltage is removed and high voltage applied, the resulting stresses can break shafts and couplings. Only closed transition starters which have no interruption of power during the starting cycle should be used.

Variable Speed Submersible Pump Operation, Inverter Drives

Franklin three phase submersible motors are operable from variable frequency inverter drives when applied within guidelines specified below. These guidelines are based on present Franklin information for inverter drives, lab tests and actual installations, and must be followed for warranty to apply to inverter drive installations.

1. Variable speed drives should be variable frequency, constant volts per Hertz type, and may have sine wave, pulse width modulated (PWM) or six-step waveshape. The base voltage should be name plate voltage and frequency of the motor.

2. Overcurrent protection in the inverter or separately furnished must trip within 10 seconds at 5 times motor maximum nameplate amps in any line, and ultimately trip within 115% of motor maximum nameplate amps in any line.

3. Any application below 30 Hertz or above 80 Hertz must be specifically approved by Franklin Engineering. Operation at lower frequency can cause motor bearing failure, and at higher frequency can raise internal hydraulic losses to an unacceptable level. If startup or shutdown frequency is ramped, the time that power is below 30 Hertz should not exceed 1 second.

4. Pump load must be selected so motor maximum nameplate amps are not exceeded under all running conditions.

5. Franklin-specified water temperature and flow past the motor must be maintained at speeds which load the motor up to maximum nameplate amps. At reduced speeds and loading, cooling flow must be adequate to maintain equivalent motor temperature.

6. Variable speed drive electronic circuits plus the inductance of the motor generally create significant levels of voltage spikes on the motor supply lines. For normal motor life expectancy, the maximum amplitude of these repetitive spikes measured from zero should not exceed 1500 volts.

7. Franklin Subtrol protection systems are not usable on inverter driven installations, because the non-sinusoidal waveshape from the inverter prevents proper Subtrol operation. The waveshape also reduces motor efficiency, typically about two percentage points.

8. To confirm whether an installation or system design is acceptable and warrantable, full details should be submitted to Franklin on Form 2207 along with inverter specifications.

Send to:
Franklin Electric
400 E. Spring Street, Bluffton, IN 46714
Attention: Field Service Department

Upon receipt and analysis of the data and installation details supplied on Form No. 2207, Franklin engineers will advise by letter if the installation will be covered by Franklin's warranty.

Submersible Motors-Inline Booster Systems

Franklin submersible motors are acceptable for booster pump (canned) applications provided the following conditions are taken into consideration in the system design.

1. **HORIZONTAL OPERATION:** Horizontal operation is acceptable as long as the pump transmits thrust to the motor and the entire assembly is supported sufficiently to prevent binding stresses.

2. The motor support assembly must not restrict the flow of cooling water around the full diameter of the motor. The motor supports must be on the motor endbell castings, and not on the stator shell.

3. **CONTROLS:** Franklin Subtrol-Plus is strongly recommended for all large submersibles. If Subtrol is not employed, properly sized ambient compensated quick-trip overloads must be utilized. In addition, a surge arrestor should be installed on all systems and properly grounded.

4. **WIRING:** Franklin lead assemblies are sized for submerged operation and may not be adequate for use in open air. Any wiring not submerged must comply with Franklin's cable charts.

5. **WATER TEMPERATURE:** The temperature of the water should be monitored at the inlet to each booster. When temperatures exceed 86°F (30°C), motor derating is required.

6. **INLET PRESSURE:** The inlet pressure on each booster should be monitored and not be allowed below the pump's specified Net Positive Suction Head Requirement (NPSHR). If NPSHR is unknown, at least 20 P.S.I. should be maintained at all times.

7. **DISCHARGE FLOW:** The flow rate for each pump should be monitored and never be allowed to drop below the minimum required to maintain cooling flow velocities. Pressure relieving valves should be employed to prevent running the pump at shut-off.

8. **DISCHARGE PRESSURE:** The discharge pressure should be great enough to prevent upthrust.

9. **CAN FLOODING:** An air bleeder valve must be employed on the booster can so total flooding may be accomplished prior to booster start-up.

IMPORTANT NOTES:

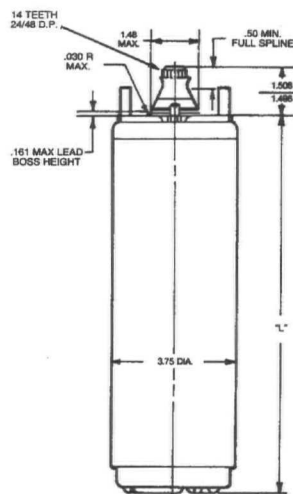
1. **HIGH PRESSURE TEST:** Motors intended for booster applications where the pressure exceeds 500 P.S.I. must be special ordered from the factory.

2. **STARTING:** Reduced voltage starting may be employed. This will reduce upthrust on start, starting current and mechanical stresses created by the motor's high starting torque. Reduced voltage starters, if used should accelerate the motor to full speed within two seconds. NOTE: Solid state reduced voltage starters are not compatible with Subtrol-Plus.

3. **DOCUMENTATION:** Form 3655, Submersible Booster Installation Record, must be completed for all Franklin submersible motor applied with inline booster pumps.

Send to:
Franklin Electric
400 E. Spring Street, Bluffton, IN 46714
Attn: Field Service Dept.

Upon receipt and analysis of the data and installation details supplied on Form No. 3655, Franklin engineers will advise by letter if the installation will be covered by Franklin's warranty.

4" Super Stainless**Dimensions****Availability**

2-Wire, Split Phase, 60 HZ, 3450 RPM

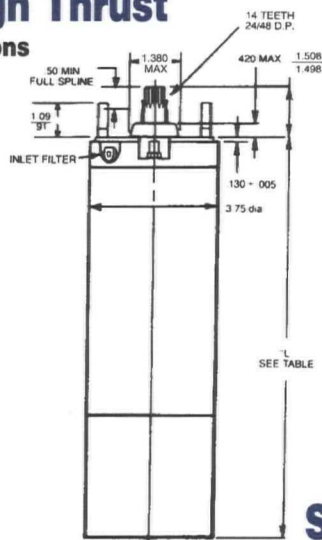
		"L" Dimension		Shipping Weight	
hp	kw	volts	in	lbs	
1/3	.25	115	8.78	16	
1/3	.25	230	8.78	16	
1/2	.37	115	9.53	18	
1/2	.37	230	9.53	18	
3/4	.55	230	10.66	21	
1	.75	230	11.75	24	
1 1/2	1.1	230	15.12	32	

3-Wire, Capacitor Start, 60 Hz, 3450 RPM

		"L" Dimension		Shipping Weight	
hp	kw	volts	in	lbs	
1/3	.25	115	8.78	16	
1/3	.25	230	8.78	16	
1/2	.37	115	9.53	18	
1/2	.37	230	9.53	18	
3/4	.55	230	10.66	21	
1	.75	230	11.75	24	
1 1/2*	1.1	230	13.62	29	
2*	1.5	230	15.12	32	

Three Phase

1/2	.37	ALL	9.53	18
3/4	.55	ALL	10.66	21
1	.75	ALL	11.75	24
1 1/2	1.1	ALL	11.75	24
2	1.5	ALL	13.62	29

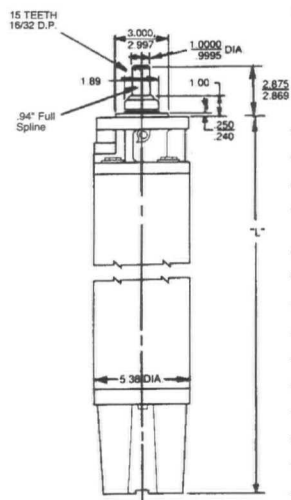
4" High Thrust**Dimensions****Availability**

Single Phase Capacitor start, capacitor run

		"L" Dimension		Shipping Weight	
hp	kw	in	lbs		
3	2.2	23.62	52		
5	3.7	29.62	69		

Three Phase

3	2.2	20.62	43
5	3.7	23.62	53
7 1/2	5.5	29.62	69
10	7.5	43.89	130

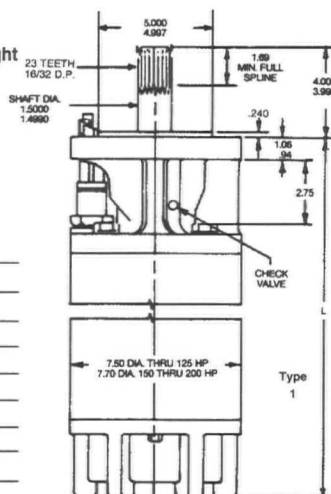
Super - 6"**Dimensions****Availability**

Single Phase Capacitor start, capacitor run

		"L" Dimension		Shipping Weight	
hp	kw	in	lbs		
5	3.7	25.44	105		
7 1/2	5.5	28.00	120		
10	7.5	30.56	135		
15	11	33.13	146		

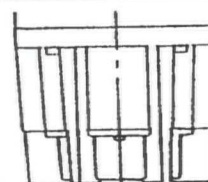
Three Phase

5	3.7	22.88	90
7 1/2	5.5	24.19	95
10	7.5	25.44	105
15	11	28.00	120
25	18	33.13	148
30	22	35.69	162
40	30	40.81	195
50	37	57.83	310
60	45	63.83	340

Super - 8"**Dimensions****Availability**

8-Inch Pump Flange (5-inch rabbet)

		"L" Dimension		Shipping Weight	
hp	kw	in	lbs	Type	
40	30	35.79	310	2	
50	37	38.79	340	2	
60	45	41.79	375	2	
75	55	47.41	450	2.1	
100	75	54.91	520	2.1	
125	90	68.78	719	1	
150	110	77.78	815	1	
175	130	85.78	919	1	
200	150	94.78	1,031	1	

Type 2
And
Type 2.1

Submersible Pump Installation Check List

This check list is intended to help in making reliable submersible pump installations. Other data for specific pumps may be needed.

1. Motor Inspection

- ___ A. Verify that the model, HP or KW, voltage, phase and hertz on the motor nameplate match the installation requirements. Consider any special corrosion resistance required.
- ___ B. Check that the motor lead assembly is tight in the motor and that the motor and lead are not damaged.
- ___ C. Test insulation resistance using a 500 or 1000 volt DC megohmmeter, from each lead wire to the motor frame. Resistance should be at least 20 megohms, motor only, no cable.
- ___ D. Keep a record of motor model number, HP or KW, voltage, date code and serial number.

2. Pump Inspection

- ___ A. Check that the pump rating matches the motor, and that it is not damaged.
- ___ B. Verify that the pump shaft turns freely.

3. Pump/Motor Assembly

- ___ A. If not yet assembled, check that pump and motor mounting faces are free from dirt and uneven paint thickness.
- ___ B. Assemble the pump and motor together so their mounting faces are in contact, then tighten assembly bolts or nuts evenly to manufacturer specifications. If it is visible, check that the pump shaft is raised slightly by assembly to the motor, confirming impeller running clearance.
- ___ C. If accessible, check that the pump shaft turns freely.
- ___ D. Assemble the pump lead guard over the motor leads. Do not cut or pinch lead wire during assembly or handling of the pump during installation.

4. Power Supply and Controls

- ___ A. Verify that the power supply voltage, hertz, and KVA capacity match motor requirements.
- ___ B. Use a matching control box with each single phase three wire motor.
- ___ C. Check that the electrical installation and controls meet all safety regulations and match the motor requirements, including fuse or circuit breaker size and motor overload protection. Connect all metal plumbing and electrical enclosures to the power supply ground to prevent shock hazard. Comply with National and local codes.

5. Lightning and Surge Protection

- ___ A. Use properly rated surge (lightning) arrestors on all submersible pump installations unless the installation is operated directly from an individual generator and/or is not exposed to surges. Motors 5HP and smaller which are marked "Equipped with Lightning Arrestors" contain internal arrestors.

- ___ B. Ground all above ground arrestors with copper wire directly to the motor frame, or to metal drop pipe or casing which reaches below the well pumping level. Connecting to a ground rod does not provide good surge protection.

6. Electrical Cable

- ___ A. Use cable suitable for use in water, sized to carry the motor current without overheating in water and in air, and complying with local regulations. To maintain adequate voltage at the motor, use lengths no longer than specified in the motor manufacturer's cable charts.
- ___ B. Include a ground wire to the pump if required by codes or surge protection, connected to the power supply ground. Always ground any pump operated outside a drilled well.

7. Well Conditions

- ___ A. For adequate cooling, motors must have at least the water flow shown on its nameplate. If well conditions and construction do not assure this much water flow will always come from below the motor, use a flow sleeve as shown in the Application, Installation & Maintenance Manual.
- ___ B. If water temperature exceeds 30 degrees C (86 °F), reduce the motor loading or increase the flow rate to prevent overheating, as specified in the Application, Installation & Maintenance Manual.

8. Pump/Motor Installation

- ___ A. Splice motor leads to supply cable using electrical grade solder or compression connectors, and carefully insulate each splice with watertight tape or adhesive-lined shrink tubing, as shown in motor or pump installation data.
- ___ B. Support the cable to the delivery pipe every 10 feet (3 meters) with straps or tape strong enough to prevent sagging. Use pads between cable and any metal straps.
- ___ C. A check valve in the delivery pipe is recommended, even though a pump may be reliable without one. More than one check valve may be required, depending on valve rating and pump setting. Install the lowest check valve below the lowest pumping level of the well, to avoid hydraulic shocks which may damage pipes, valve or motor.
- ___ D. Assemble all pipe joints as tightly as practical, to prevent unscrewing from motor torque. Recommended torque is at least 10 pound feet per HP (2 meter-KG per KW).
- ___ E. Set the pump far enough below the lowest pumping level to assure the pump inlet will always have at least the Net Positive Suction Head (NPSH) specified by the pump manufacturer, but at least 10 feet (3 meters) from the bottom of the well to allow for sediment build up.

Submersible Pump Installation Check List

- ____ F. Check insulation resistance from dry motor cable ends to ground as the pump is installed, using a 500 or 1000 volt DC megohmmeter. Resistance may drop gradually as more cable enters the water, but any sudden drop indicates possible cable, splice or motor lead damage. Resistance should meet motor manufacturer data.

9. After Installation

- ____ A. Check all electrical and water line connections and parts before starting the pump. Make sure water delivery will not wet any electrical parts, and recheck that overload protection in three phase controls meets requirements.
- ____ B. Start the pump and check motor amps and pump delivery. If normal, continue to run the pump until delivery is clear. If three phase pump delivery is low, it may be running backward because phase sequence is reversed. Rotation may be reversed (with power off) by interchanging any two motor lead connections to the power supply.
- ____ C. Connect three phase motors for current balance within 5% of average, using motor manufacturer instructions. Unbalance over 5% will cause higher motor temperatures and may cause overload trip, vibration, and reduced life.
- ____ D. Make sure that starting, running and stopping cause no significant vibration or hydraulic shocks.
- ____ E. After at least 15 minutes running, verify that pump output, electrical input, pumping level, and other characteristics are stable and as specified.

Date _____ Filled In By _____

10. Installation Data

Well Identification _____

Check By _____

Date ____ / ____ / ____

Notes _____

Submersible Motor Installation Record

RMA No. _____

INSTALLER'S NAME _____ OWNER'S NAME _____

ADDRESS _____ ADDRESS _____

CITY _____ STATE _____ ZIP _____ CITY _____ STATE _____ ZIP _____

PHONE (____) _____ FAX (____) _____ PHONE (____) _____ FAX (____) _____

CONTACT NAME _____ CONTACT NAME _____

WELL NAME/ID _____ DATE INSTALLED _____

WATER TEMPERATURE _____ ° F/C (CIRCLE F OR C AS APPROPRIATE)

MOTOR:

Motor No. _____ Date Code _____ HP _____ Voltage _____ Phase _____

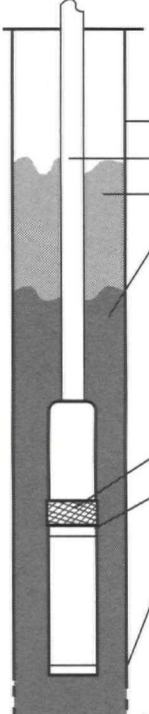
PUMP:

Manufacturer _____ Model No. _____ Curve No. _____ Rating: _____ GPM@ _____ ft. TDH

NPSH Required: _____ ft. NPSH Available: _____ ft. Actual Pump Delivery _____ GPM@ _____ PSI

Operating Cycle: _____ ON (Min./Hr.) _____ OFF (Min./Hr.) (Circle Min. or Hr. as appropriate)

YOUR NAME _____ DATE ____/____/____



WELL DATA:

Total Dynamic Head _____ ft.

Casing Diameter _____ in.

Drop Pipe Diameter _____ in.

Static Water Level _____ ft.

Drawdown (pumping) Water Level _____ ft.

Checkvalves at _____ & _____ &
_____ & _____ ft.

☐ Solid ☐ Drilled

Pump Inlet Setting _____ ft.

Flow Sleeve: ☐ No ☐ Yes, Dia. _____ in.

Casing Depth _____ ft.

☐ Well Screen ☐ Perforated Casing

From _____ to _____ ft. & _____ to _____ ft.

Well Depth _____ ft.

TOP PLUMBING:

Please sketch the plumbing after the well head (check valves, throttling valves, pressure tank, etc.) and indicate the setting of each device.

Submersible Motor Installation Record

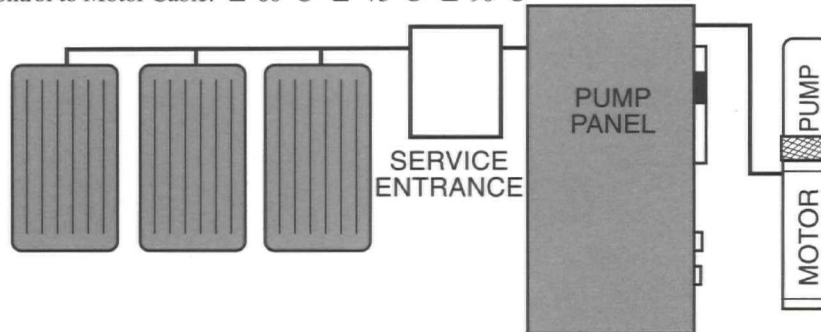
POWER SUPPLY:

Cable: Service Entrance to Control _____ ft. _____ AWG/MCM ☐ Copper or ☐ Aluminum, ☐ Jacketed or ☐ Individual Conductors

Cable: Control to Motor _____ ft. _____ AWG/MCM ☐ Copper or ☐ Aluminum, ☐ Jacketed or ☐ Individual Conductors

Temperature Rating of Service Entrance to Control Cable: ☐ 60 °C ☐ 75 °C ☐ 90 °C

Temperature Rating of Control to Motor Cable: ☐ 60 °C ☐ 75 °C ☐ 90 °C



Transformers:

KVA _____ #1 _____ #2 _____ #3

Initial Megs (motor & lead) T1 _____ T2 _____ T3 _____

Final Megs (motor, lead & cable) T1 _____ T2 _____ T3 _____

Incoming Voltage:

No Load: L1-L2 _____ L2-L3 _____ L1-L3 _____

Full Load: L1-L2 _____ L2-L3 _____ L1-L3 _____

Running Amps:

HOOKUP 1:

Full Load: L1 _____ L2 _____ L3 _____

%Unbalance _____

HOOKUP 2:

Full Load: L1 _____ L2 _____ L3 _____

%Unbalance _____

HOOKUP 3:

Full Load: L1 _____ L2 _____ L3 _____

%Unbalance _____

Comments: _____

Control Panel:

Panel Manufacturer: _____

Short Circuit Device: ☐ Circuit Breaker: Rating _____ Setting _____

☐ Fuses: Rating _____ Type _____

☐ Standard ☐ Delay

Starter Manufacturer: _____ Starter Size _____

Type of Starter: ☐ Full Voltage ☐ Autotransformer

☐ Other: _____ Full Voltage in _____ sec.

Heaters Manufacturer: _____

Number _____ Adjustable Set at: _____ amps.

Subtrol-Plus: ☐ No ☐ Yes: Registration No. _____

If yes, Overload Set? ☐ No ☐ Yes Set at _____ amps.

Underload Set? ☐ No ☐ Yes Set at _____ amps.

Controls are Grounded to: ☐ Well Head ☐ Motor

☐ Rod ☐ Power Supply

Ground Wire Size: _____ AWG/MCM

Submersible Motor Booster Installation Record

Date ____ / ____ / ____ Filled In By _____ RMA No. _____

Installation

Owner/User: _____ Telephone (____) _____
Address: _____ City _____ State _____ Zip _____
Installation Site, If Different: _____
Contact: _____ Telephone (____) _____
System Application _____

System Manufactured By: _____
Model _____ Serial No. _____
System Supplied By: _____ City _____ State _____ Zip _____

Motor

Model No. _____ Serial No. _____ Date Code _____
Horsepower: _____ Voltage: _____ Single Phase _____ Or Three Phase _____ Dia: _____ In.
Slinger Removed? Yes _____ No _____ Check Valve Plug Removed? Yes _____ No _____

Pump

Manufacturer: _____ Model _____ Serial No. _____
Stages: _____ Diameter _____ Flow Rate Of _____ GPM At _____ TDH
Booster Case: Internal Diameter: _____ Construction _____

Controls and Protective Devices

Subtrol? Yes _____ No _____ If Yes, Warranty Registration No. _____
If Yes, Overload Set? Yes _____ No _____ Set At _____
Underload Set? Yes _____ No _____ Set At _____
Reduced Voltage Starter? Yes _____ No _____ If Yes, Type _____
Mfr. _____ Setting _____ % Full Voltage In _____ Seconds
Pump Panel? Yes _____ No _____ If Yes, Mfr. _____ Size _____
Magnetic Starter/Contactor: Mfr. _____ Model _____ Size _____
Heaters: Mfr. _____ No. _____ If Adjustable; Set At _____
Fuses: Mfr. _____ Size _____ Type _____
Lightning/Surge Arrestor: Mfr. _____ Model _____
Controls Are Grounded: to _____ with No. _____ Wire _____
Inlet Pressure Control: Yes _____ No _____ If Yes, Mfr. _____ Model _____ Setting _____ PSI
Inlet Flow Control: Yes _____ No _____ If Yes, Mfr. _____ Model _____ GPM
Outlet Pressure Control: Yes _____ No _____ If Yes, Mfr. _____ Model _____ PSI
Outlet Flow Control: Yes _____ No _____ If Yes, Mfr. _____ Model _____ GPM
Water Temperature Control: Yes _____ No _____ If Yes, Mfr. _____ Model _____
Set At _____ °F Or _____ °C Located _____

Submersible Motor Booster Installation Record

Insulation Check (Motor Lead to Ground)

Initial Megs: Motor & Lead Only Black _____ Yellow _____ Red _____

Installed Megs: Motor, Lead, & Cable Black _____ Yellow _____ Red _____

Voltage To Motor

Non-Operating: B-Y _____ Y-R _____ R-B _____

At Rated Flow of _____ GPM B-Y _____ Y-R _____ R-B _____

At Open Flow _____ GPM B-Y _____ Y-R _____ R-B _____

Amps To Motor

At Rated Flow Of _____ GPM Black _____ Yellow _____ Red _____

At Open Flow _____ GPM Black _____ Yellow _____ Red _____

At Shut Off* Black _____ Yellow _____ Red _____

*Do NOT Run at Shut Off more Than Two (2) minutes.

Inlet Pressure: _____ PSI Outlet Pressure: _____ Water Temp: _____ °F Or _____ °C

Warranty On Three Phase Submersible Motors Is Void Unless Subtrol Or Proper Quick Trip Ambient Compensated Protection Is Used On All Three (3) Motor Lines.

If you have any Questions or Problems, Call The Franklin Electric Toll Free Hot Line: 1-800-348-2420

Comments: _____

Please Sketch The System

Submersible Leads And Cables

Occasionally we are asked why motor leads furnished with or for Franklin submersible motors are smaller than allowed in Franklin's cable selection charts.

The leads are considered part of the motor and actually are a connection between the larger supply wire and much smaller wire generally found inside the motor. In addition, their length is so short that there is virtually no voltage drop across the lead.

The most important reason is that the lead assemblies are intended to operate under water, while at least part of the supply cable must operate in air. Operating in water cools cable to a small fraction of its temperature operating in air, permitting standardization to relatively small lead sizes on wide ranges of motor ratings. This minimizes the number of different replacement leads required and allows for smaller pump cable guards, which results in more well clearance.

Cable temperature rise tests which support this information are part of the approval process at both U.L. and CSA.

This information brings up one very important reminder: The lead assembly on most submersible motors is suitable only for use in water and may overheat and cause failure if operated in air. Any portion of the cable/lead combination which is to operate in air must comply with the cable charts.

Splicing Submersible Cables

When the drop cable must be spliced or connected to the motor leads, it is necessary that the splice be water tight. This splice can be made with commercially available potting or heat shrink splicing kits or by careful tape splicing.

Tape splicing should use the following procedure.

- Strip individual conductor of insulation only as far as necessary to provide room for a stake type connector. Tubular connectors of the staked type are preferred. If connector O.D. is not as large as cable insulation, build-up with rubber electrical tape.
- Tape individual joints with rubber electrical tape, using two layers; the first extending two inches beyond each end of the conductor insulation end, the second layer two inches beyond the ends of the first layer. Wrap tightly, eliminating air spaces as much as possible.
- Tape over the rubber electrical tape with #33 Scotch electrical tape, (Minnesota Mining Co.) or equivalent, using two layers as in step "B" and making each layer overlap the end of the preceding layer by at least two inches.

In the case of a cable with three conductors encased in a single outer sheath, tape individual conductors as described, staggering joints.

Total thickness of tape should be no less than the thickness of the conductor insulation.

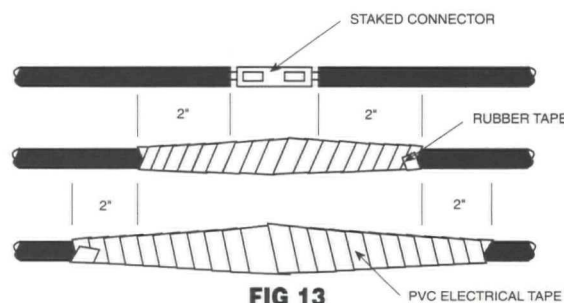


FIG 13

Tightening Motor Lead Connector Jam Nut

- 4" Motors-15 to 20 Lb. Ft. (2.1 to 2.8 Meter-KG)
 1 3/16", 1 1/4" Jam Nut-60 to 70 Lb. Ft. (8.3 to 9.7 Meter-KG)
 1 5/8" Jam Nut-120 to 150 Lb. Ft. (16.6 to 20.7 Meter-KG)

A motor lead assembly should not be reused. A new lead assembly should be used whenever one is removed from the motor, because rubber set and possible damage from the removal may prevent proper resealing of the old lead.

All motors returned for warranty consideration must have the motor lead returned with the motor.

Pump to Motor Coupling

Assemble coupling with non-toxic FDA approved waterproof grease such as Mobil FM102, Texaco CYGNUS2661, or approved equivalent. Besides prolonging spline life of motor and coupling, it prevents abrasives from entering the spline area.

Shaft Height and Free End Play

Table 18

Motor	Nominal Shaft Height	Dimension Shaft Height	Free End Play	
			Min.	Max.
4" Super Stainless	1 1/2"	1.508" 1.498"	.010"	.045"
4" High Thrust	1 1/2"	1.508" 1.498"	.010"	.045"
6"	2 7/8"	2.875" 2.869"	.030"	.050"
8" Type 1	4"	4.000" 3.990"	.008"	.020"
8" Type 2	4"	4.000" 3.990"	.035"	.060"
8" Type 2.1	4"	4.000" 3.990"	.030"	.080"

1 Inch = 25.4 Millimeter

If the shaft height measured from the pump mounting surface of a motor is low and/or end play exceeds the limit, the motor thrust bearing is possibly damaged, and should be replaced.

System Trouble Shooting

Motor Does Not Start

Cause of Trouble	Checking Procedure	Correction Action
A. No power or incorrect voltage	Using voltmeter check the line terminals Voltage must be $\pm 10\%$ of rated voltage.	Contact power company if voltage is incorrect.
B. Fuses blown or circuit breakers tripped	Check fuses for recommended size and check for loose, dirty or corroded connections in fuse receptacle. Check for tripped circuit breaker.	Replace with proper fuse or reset circuit breaker.
C. Defective pressure switch.	Check voltage at contact points. Improper contact of switch points can cause voltage less than line voltage.	Replace pressure switch or clean points.
D. Control box malfunction.	For detailed procedure, see page 29, 30 & 31.	Repair or replace.
E. Defective wiring.	Check for loose or corroded connections Check motor lead terminals with voltmeter for power.	Correct faulty wiring or connections
F. Bound pump.	Locked rotor conditions can result from misalignment between pump and motor or a sand bound pump. Amp readings 3 to 6 times higher than normal will be indicated.	If pump will not start with several trials it must be pulled and the cause corrected. New installations should always be run without turning off until water clears.
G. Defective cable or motor.	For detailed procedure, see pages 26, 27 & 28.	Repair or replace.

Motor Starts Too Often

A. Pressure switch.	Check setting on pressure switch and examine for defects.	Reset limit or replace switch.
B. Check valve, stuck open.	Damaged or defective check valve will not hold pressure.	Replace if defective.
C. Waterlogged tank, (air supply)	Check air charging system for proper operation.	Clean or replace.
D. Leak in system.	Check system for leaks.	Replace damaged pipes or repair leaks.

System Trouble Shooting

Motor Runs Continuously

Cause of Trouble	Checking Procedure	Correction Action
A. Pressure switch.	Switch contacts may be "welded" in closed position. Pressure switch may be set too high.	Clean contacts replace switch, or readjust setting.
B. Low level well.	Pump may exceed well capacity. Shut off pump, wait for well to recover. Check static and drawdown level from well head.	Throttle pump output or reset pump to lower level. Do not lower if sand may clog pump.
C. Leak in system.	Check system for leaks.	Replace damaged pipes or repair leaks.
D. Worn pump.	Symptoms of worn pump are similar to those of drop pipe leak or low water level in well. Reduce pressure switch setting, if pump shuts off worn parts may be at fault. Sand is usually present in tank.	Pull pump and replace worn impellers, casing or other close fitting parts.
E. Loose or broken motor shaft.	No or little water will be delivered if coupling between motor and pump shaft is loose or if a jammed pump has caused the motor shaft to shear off.	Check for damaged shafts if coupling is loose and replace worn or defective units.
F. Pump screen blocked.	Restricted flow may indicate a clogged intake screen on pump. Pump may be installed in mud or sand.	Clean screen and reset at less depth. It may be necessary to clean well.
G. Check valve stuck closed.	No water will be delivered if check valve is in closed position.	Replace if defective.
H. Control box malfunction.	See page 29, 30 & 31 for single phase.	Repair or replace.

Motor Runs But Overload Protector Trips

A. Incorrect voltage	Using voltmeter, check the line terminals. Voltage must be within $\pm 10\%$ of rated voltage.	Contact power company if voltage is incorrect.
B. Overheated protectors.	Direct sunlight or other heat source can make control box hot causing protectors to trip. The box must not be hot to touch.	Shade box, provide ventilation or move box away from heat source.
C. Defective control box.	For detailed procedures, see pages 29, 30 & 31.	Repair or replace.
D. Defective motor or cable.	For detailed procedures, see pages 26, 27 & 28.	Repair or replace.
E. Worn pump or motor.	Check running current, See pages 11, 14 & 15.	Replace pump and/or motor.

Table 19 Preliminary Tests - All Sizes-Single & Three Phase

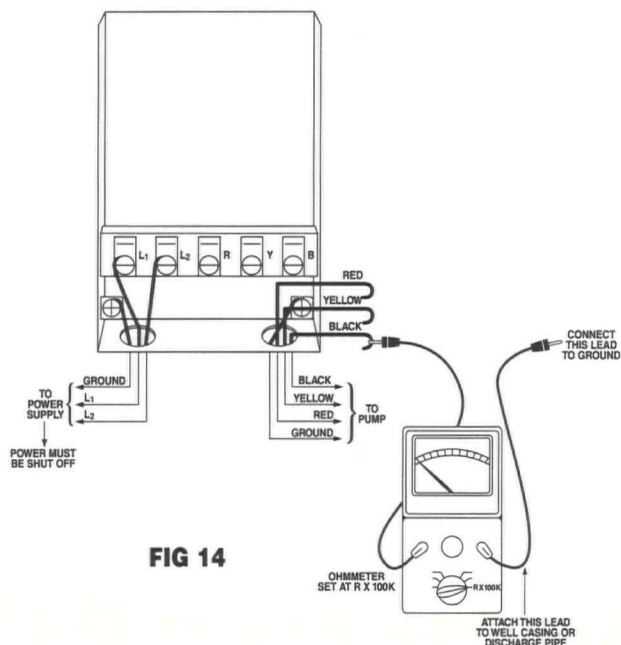
What Is to Be Done	The Results	What It Means
Measure resistance from any cable to ground. (Insulation resistance)	Ohms will be per Table 20	<ol style="list-style-type: none"> 1. If the ohm value is normal, the motor windings are not grounded and the cable insulation is not damaged. 2. If the ohm value is below normal, either the windings are grounded or the cable insulation is damaged. Check the cable at the well seal as the insulation is sometimes damaged by being pinched.
Measure winding resistance. (Resistance between leads)	Ohms will be per Tables 8, 12 & 13.	<ol style="list-style-type: none"> 1. If all ohm values are normal, the motor windings are neither shorted nor open, and the cable colors are correct. 2. If any one ohm value is less than normal, the motor is shorted. 3. If any one ohm value is greater than normal, the winding or the cable is open, or there is a poor cable joint or connection. 4. If some ohm values are greater than normal and some less on single phase motors, the leads are mixed. See page 28 to verify cable colors.

How to Measure Insulation Resistance.

1. Set the scale lever to R x 100K and set the ohmmeter on zero.

2. CAUTION

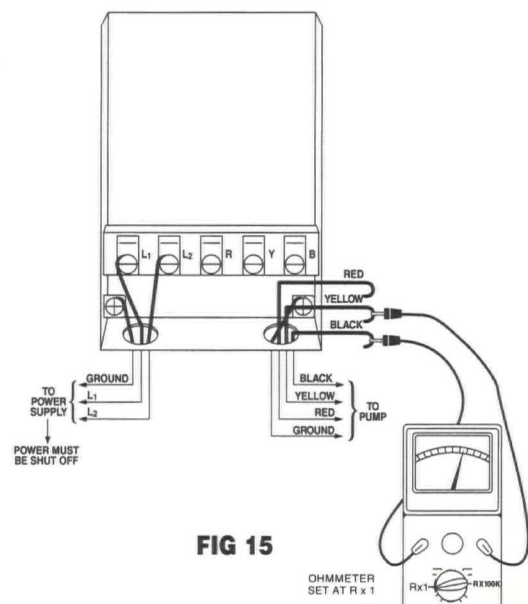
Open master breaker and disconnect all leads from control box or pressure switch (Q-D type control, remove lid) to avoid damage to meter or electric shock hazard. Connect one ohmmeter lead to any one of the motor leads and the other lead to the metal drop pipe. If the drop pipe is plastic, connect the ohmmeter lead to ground.

**How to Measure Winding Resistance.**

1. Set the scale lever to R x 1 for values under 10 ohms. For values over 10 ohms, set the scale lever to R x 10. Zero balance the ohmmeter.

2. CAUTION

Open master breaker and disconnect all leads from control box or pressure switch (Q-D type control, remove lid) to avoid damage to meter or electric shock hazard.



Insulation Resistance Readings

Table 20 Normal Ohm and Megohm Values Between All Leads and Ground

Insulation resistance varies very little with rating. Motors of all HP, voltage, and phase rating have similar values of insulation resistance.

Condition of Motor and Leads	OHM Value	MEGOHM Value
A new motor (without drop cable).	20,000,000 (or more)	20.0 (or more)
A used motor which can be reinstalled in the well	10,000,000 (or more)	10.0 (or more)
MOTOR IN WELL. Ohm readings are for drop cable plus motor.		
A new motor in the well.	2,000,000 (or more)	2.0 (or more)
A motor in the well in reasonably good condition.	500,000 - 2,000,000	0.5 - 2.0
A motor which may have been damaged by lightning or with damaged leads. Do not pull the pump for this reason.	20,000 - 500,000	0.02 - 0.5
A motor which definitely has been damaged or with damaged cable. The pump should be pulled and repairs made to the cable or the motor replaced. The motor will not fail for this reason alone, but it will probably not operate for long.	10,000 - 20,000	0.01 - 0.02
A motor which has failed or with completely destroyed cable insulation. The pump must be pulled and the cable repaired or the motor replaced.	less than 10,000	0 - 0.01

Resistance of Drop Cable (Ohms)

The values below are for copper conductors. If aluminum conductor drop cable is used, the resistance will be higher for each foot of cable of the same size. To determine the actual

resistance of aluminum drop cable, divide the ohm readings from this chart by 0.61. This chart shows total resistance of cable from control to motor and back.

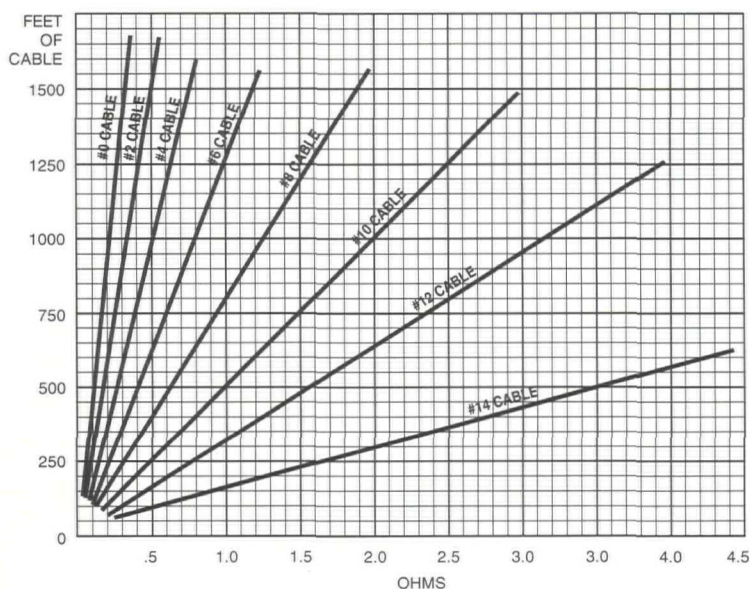


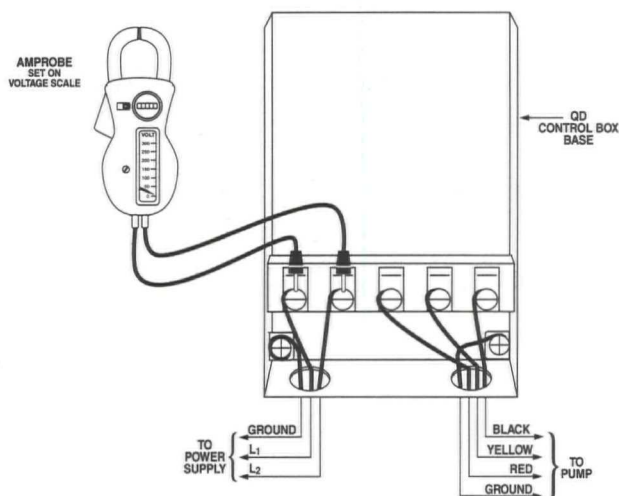
FIG 16

Winding Resistance Measuring

When measured as shown in FIG 15 page 26, motor resistance should fall within the values in Tables 8, 12 & 13. When measured through the drop cable, the resistance of the drop cable as determined from the chart at the left, must be subtracted from the ohmmeter reading to get the winding resistance of the motor.

Meter Connections for Motor Testing

FIG 17



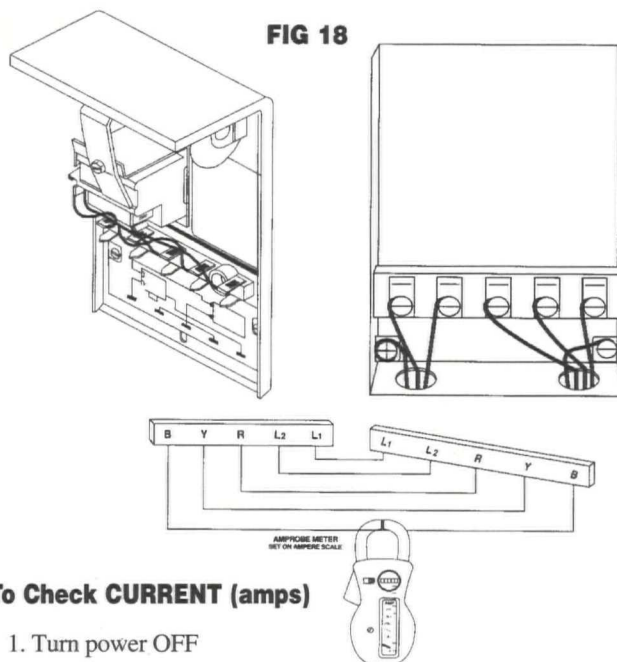
To Check VOLTAGE

1. Turn power OFF
2. Remove QD cover to break all motor connections.

CAUTION: L1 & L2 are still connected to the power supply.

3. Turn power ON.
4. Use voltmeter as shown.

FIG 18



To Check CURRENT (amps)

1. Turn power OFF
2. Connect test cord (No. 150961901) as shown.
3. Turn power ON.
4. Use hook-on type ammeter as shown.

CAUTION: Both voltage and current tests require live circuits with power ON.

Identification Of Cables When Color Code Is Missing (FOR SINGLE PHASE 3-WIRE UNITS ONLY)

If the colors on the individual drop cables cannot be found; that is, if no colored threads are visible and no identifying ribs are present and the leads cannot be identified.

With an ohmmeter, measure;
 Cable 1 to cable 2
 Cable 2 to cable 3
 Cable 3 to cable 1

Find the highest resistance reading.

The lead not used in the highest reading is the yellow lead.

Use the yellow lead and each of the other two leads to get two readings:

Highest is the Red lead
 Lowest is the Black lead

Example

Suppose that the ohmmeter readings were;
 Cable 1 to cable 2---6 ohms
 Cable 2 to cable 3---2 ohms
 Cable 3 to cable 1---4 ohms

The lead not used in the highest reading (6 ohms) was
 Cable 3---Yellow

From the Yellow lead, the highest reading (4 ohms) was
 To Cable 1---Red

From the Yellow lead, the lowest reading (2 ohms) was
 To Cable 2---Black

Single Phase Control Boxes

Checking and Repairing Procedures (Power On)

CAUTION: Power must be on for these tests. Do not touch any live parts.

A. General Procedures:

1. Establish line power.
2. Check no load voltage (pump not running).
3. Check load voltage (pump running).
4. Check current (amps) in all motor leads.

B. Use of Volt/Amp meter:

1. Meter such as Amprobe Model RS300 or equivalent may be used.
2. Select scale for voltage or amps depending on tests.
3. When using amp scales, select highest scale to allow for inrush current, then select for midrange reading.

C. Voltage Measurements:

Step 1, no load.

1. Measure voltage at L1 and L2 of pressure switch or line contactor.
2. Voltage Reading: Should be $\pm 10\%$ of motor rating.

Step 2, load.

1. Measure voltage at load side of pressure switch or line contactor with pump running.
2. Voltage Reading: Should remain the same except for slight dip on starting.

D. Current (Amp) Measurements:

1. Measure current on all motor leads. Use 5 conductor test cord for Q.D. control boxes.
2. Amp Reading: Current in Red lead should momentarily be high, then drop within one second to values on page 11. This verifies relay or solid state relay operation. Current in Black and Yellow leads should not exceed values on page 11.

E. Voltage Symptoms:

1. Excessive voltage drop on starting.
2. Causes: Loose connections, bad contacts or ground faults, or inadequate power supply.

F. Current Symptoms:

1. Relay or switch failures will cause Red lead current to remain high and overload tripping.
2. Open run capacitor(s) will cause amps to be higher than normal in the Black and Yellow motor leads and lower than normal or zero amps in the Red motor lead.
3. Relay chatter is caused by low voltage or ground faults.
4. A bound pump will cause locked rotor amps and overloading tripping.
5. Low amps may be caused by pump running at shutoff, worn pump or stripped splines.
6. Failed start capacitor or open switch/relay are indicated if the red lead current is not momentarily high at starting.

CAUTION:

The tests in this manual for components such as capacitors, relays, and solid state switches should be regarded as indicative and not as conclusive. For example, a capacitor may test good (not open, not shorted) but it may have lost some of its capacitance and may no longer be able to perform its function.

To verify proper operation of solid state switches or relays, refer to operational test procedure described in paragraph D-2.

Single Phase Control Boxes

Checking and Repairing Procedures (Power Off)

CAUTION: Turn power off at the power supply panel and discharge capacitors before using ohmmeter.

A. General Procedures:

1. Disconnect line power.
2. Inspect for damaged or burned parts, loose connections, etc.
3. Check against diagram in control box for misconnections.
4. Check motor insulation and winding resistance.

B. Use of Ohmmeter:

1. Ohmmeter such as Simpson Model 372 or 260. Triplet Model 630 or 666 may be used.
2. Whenever scales are changed, clip ohmmeter lead together and "zero balance" meter.

C. Ground (Insulation Resistance) Test:

1. Ohmmeter Setting: Highest scale R x 10K, or R x 100K
2. Terminal Connections: One ohmmeter lead to "Ground" terminal or Q.D. control box lid and touch other lead to the other terminals on the terminal board.
3. Ohmmeter Reading: Pointer should remain at infinity (∞).

Additional Tests

Solid State Capacitor Run (CRC) Control Box

A. Run Capacitor

1. Meter setting: R x 1,000
2. Connections: Red and Black leads
3. Correct meter reading:
Pointer should swing toward zero, then drift back to infinity.

B. Inductance Coil

1. Meter setting: R x 1
2. Connections: Orange leads
3. Correct meter reading:
Less than 1 ohm.

C. Solid State Switch

Step 1 Triac Test

1. Meter setting: R x 1,000
2. Connections: R(Start) terminal and Orange lead on start switch.
3. Correct meter reading:
Should be near infinity after swing.

Step 2, Coil Test

1. Meter setting: R x 1
2. Connections: Y(Common) and L2.
3. Correct meter reading:
Zero ohms.

Ohmmeter Tests

Quick Disconnect (QD) Solid State Control Box

A. Start Capacitor

1. Meter Setting: R x 1,000.
2. Connections: Capacitor terminals.
3. Correct meter reading:
Pointer should swing toward Zero, then back to infinity.

B. Solid State Switch

Step 1, Triac Test

1. Meter Setting: R x 1,000.
2. Connections: R(Start) terminal and orange lead on start switch.
3. Correct meter reading:
Infinity for all models.

Step 2 Coil Test

1. Meter Setting: R x 1.
2. Connections: Y(Common) and L2.
3. Correct meter reading:
Zero ohms for all models.

C. Potential (Voltage) Relay

Step 1, Coil Test

1. Meter setting: R x 1,000.
2. Connections: #2 & #5.
3. Correct meter readings:
For 115 Volt Boxes
.7-1.8 (700 to 1,800 ohms).
For 230 Volt Boxes
4.5-7.0 (4,500 to 7,000 ohms).

Step 2, Contact Test

1. Meter setting: R x 1.
2. Connections: #1 & #2.
3. Correct meter reading:
Zero for all models.

D. Current Relay

Step 1, Coil Test.

1. Meter setting: R x 1.
2. Connections: #1 & #3.
3. Correct meter reading:
Less than 1 ohm for all models.

Step 2, Contact Test

1. Meter setting: R x 1,000.
2. Connections: #2 & #4.
3. Correct meter reading:
Infinity for all models.

E. Q.D. (Blue) Relay

Step1. Triac Test

1. Meter setting: R x 1000.
2. Connections: Cap and B terminal.
3. Correct meter reading:
Infinity for all models.

Step 2, Coil Test

1. Meter Setting: R x 1.
2. Connections: L1 and B.
3. Correct meter reading:
Zero ohms for all models.

Ohmmeter Tests Integral Horsepower Control Box (Power Off)

A. OVERLOADS (Push Reset Buttons to make sure contacts are closed.)

1. Meter Setting: R x 1.
2. Connections: Overload terminals.
3. Correct meter reading: Should not be more than 0.5 ohms.

B. CAPACITOR (Disconnect leads from one side of each capacitor before checking.)

1. Meter Setting: R x 1,000.
2. Connections: Capacitor terminals.
3. Correct meter reading: Pointer should swing toward zero, then drift back to infinity, except for capacitors with resistors which will drift back to 15,000 ohms.

C. RELAY COIL (Disconnect lead from Terminal #5)

1. Meter Setting: R x 1,000.
2. Connections: #2 & #5.
3. Correct meter readings: 4.5-7.0 (4,500 to 7,000 ohms) for all models.

D. RELAY CONTACT (Disconnect lead from Terminal #1)

1. Meter Setting: R x 1.
2. Connections: #1 & #2.
3. Correct meter reading: Zero ohms for all models.

E. CONTACTOR COIL (Disconnect lead from one side of coil)

1. Meter Setting: R x 100.
2. Connections: Coil terminals.
3. Correct meter reading: 180 to 1,400 ohms

F. CONTACTOR CONTACTS

1. Meter Setting: R X 1.
2. Connections: L1 & T1 or L2 & T2.
3. Manually close contacts.
4. Correct meter reading: Zero ohms.

Table 21 QD Control Box Parts

HP	VOLTS	CONTROL BOX MODEL NO.	(1) SOLID STATE SW OR QD (BLUE) RELAY	START CAPACITOR	MFD	VOLTS	RUN CAPACITOR	MFD	VOLTS	COIL
1/3	115	2801024910	152138905(5)	275464125	159-191	115				
		2801024915	223415905(5)	275464125	159-191	115				
1/3	230	2801034910	152138901(5)	275464126	43-53	220				
		2801034915	223415901(5)	275464126	43-53	220				
1/2	115	2801044910	152138906(5)	275464201	250-300	125				
		2801044915	223415906(5)	275464201	250-300	125				
1/2	230	2801054910	152138902(5)	275464105	59-71	220				
		2801054915	223415902(5)	275464105	59-71	220				
1/2	230	2824055010	152138912	275470115	43-52	220	155328101	15	370	155662901
		2824055015	223415912(6)	275464105	59-71	220	155327107	15	370	
3/4	230	2801074910	152138903(5)	275464118	86-103	220				
		2801074915	223415903(5)	275464118	86-103	220				
3/4	230	2824075010	152138913	275470114	108-130	220	155327108	23	370	155662901
		2824075015	223415913(6)	275464118	86-103	220	155327108	23	370	
1	230	2801084910	152138904(5)	275464113	105-126	220				
		2801084915	223415904(5)	275464113	105-126	220				
1	230	2824085010	152138914	275470114	108-130	220	155327108	23	370	155662901
		2824085015	223415914(6)	275470114	108-130	220	155327108	23	370	

Footnotes:

- (1) Prefixes 152 are solid state switches.
Prefixes 223 are QD (Blue) Relays.
- (2) Control boxes supplied with solid state relays are designed to operate on normal 230v systems.
For 208v systems or where line voltage is between 200v and 210v use the next larger cable size,
or use boost transformer to raise the voltage to 230 volts.
- (3) Voltage relays kits 115 volts. 305102 901 and 230 volt. 305102 902 will replace either current,
voltage or QD Relays, and solid state switches.
- (4) QD control boxes produced H85 or later do not contain an overload in the capacitor. On winding
thermal overloads were added to three-wire motors rated 1/3 - 1 hp in A85. If a control box dated
H85 or later is applied with a motor dated M84 or earlier, overload protection can be provided by
adding an overload kit to the control box.
- (5) May be replaced with QD relay kits 305101 901 thru 906. Use same kit suffix as switch
or relay suffix.

(6) Replace with CRC QD Relaying Kits, 223 415 912 with 305 105 901, 223 415 913 with
305 105 902 and 223 415 914 with 305 105 903.

Table 22 Overload Kits

- (1) For Control Boxes with
model numbers that
end with 915.
- (2) For Control Boxes with
model numbers that
end with 910.

HP	Volts	Kit Number (1)	Kit Number (2)
1/3	115	305100901	305091 901
1/3	230	305100902	305091 902
1/2	115	305100903	305091 903
1/2	230	305100904	305091 904
3/4	230	305100905	305091 905
1	230	305100906	305091 906

TABLE 23 Integral Horsepower Control Box Parts

Motor Rating HP, Dia.	Control Box (1) Model No.	Capacitors				Overload (2) Part No.	Relay (7) Part No.	Contactor (2) Part No.
		Part No.	MFD	Volts	Qty.			
1 1/2-4"	282 3008 110	275 464 113 S	105-126	220	1	275 411 107	155 031 102	
		155 328 102 R	10	370	1			
	282 3007 202 or 282 3007 102	275 461 107 S	105-126	220	1	151 496 922	155 031 102	
		275 479 102 R (5)	10	370	1	151 033 946 (3)		
282 3007 203 or 282 3007 103	275 461 107 S	105-126	220	1	151 496 922	155 031 102		
	155 328 102 R	10	370	1	151 033 946 (3)			
2-4"	282 3018 110	275 464 113 S	105-126	220	1	275 411 107 S	155 031 102	
		155 328 103 R	20	370	1	275 411 113 M		
	282 3018 202	275 464 113 S	105-126	220	1	275 411 107 S	155 031 102	
		275 479 105 R (5)	20	370	1	275 411 112 M		
	282 3018 203 or 282 3018 103	275 464 113 S	105-126	220	1	275 411 107 S	155 031 102	
		155 328 103 R	20	370	1	275 411 113 M		
2-4" DLX	282 3018 310	275 464 113 S	105-126	220	1	275 411 107 S	155 031 102	155 325 102 L
		155 328 103 R	20	370	1	275 411 113 M		
	282 3019 103	275 464 113 S	105-126	220	1	275 411 107 S	155 031 102	155 325 102 L
		155 328 103 R	20	370	1	275 411 102 M		
3-4"	282 3028 110	275 463 111 S	208-250	220	1	275 411 108 S	155 031 102	
		155 327 102 R	35	370	1	275 411 115 M		
	282 3028 202	275 463 111 S	208-250	220	1	275 411 108 S	155 031 102	
		275 481 102 R (5)	35	370	1	275 406 120 M		
	282 3028 203 or 282 3028 103	275 463 111 S	208-250	220	1	275 411 108 S	155 031 102	
		155 327 102 R	35	370	1	275 406 120 M		
3-4" DLX	282 3028 310	275 463 111 S	208-250	220	1	275 411 108 S	155 031 102	155 325 102 L
		155 327 102 R	35	370	1	275 411 115 M		
	282 3029 103	275 463 111 S	208-250	220	1	275 411 108 S	155 031 102	155 325 102 L
		155 327 102 R	35	370	1	275 406 120 M		
5-4" & 6"	282 1138 110	275 468 118 S	216-259	330	1	275 411 102 S	155 031 102	
		155 327 101 R	30	370	2	275 406 102 M		
5-4"	282 1139 202	275 468 118 S	216-259	330	1	275 411 102 S	155 031 102 (6)	
		275 479 103 R (5)	15	370	4	275 406 102 M		
	282 1139 203 or 282 1139 003	275 468 118 S	216-259	330	1	275 411 102 S	155 031 102 (6)	
		155 327 101 R	30	370	2	275 406 102 M		
5-4" & 6" DLX	282 1138 310 or 282 1139 310	275 468 118 S	216-259	330	1	275 411 102 S	155 031 102	155 325 102 L
		155 327 101 R	30	370	2	275 406 102 M		
5-4"	282 1139 303 or	275 468 118 S	216-259	330	1	275 411 102 S	155 031 102 (6)	155 325 102 L

See page 33 for footnotes.

Table 24 Integral Horsepower Control Box Parts

Motor Rating HP, Dia.	Control Box (1) Model No.	Capacitors				Overload (2) Part No.	Relay (7) Part No.	Contactor (2) Part No.
		Part No. (2)	MFD	Volts	Qty.			
5-6"	282 2009 202	275 468 117 S 275 479 103 R (5)	130-154 15	330 370	2 2	155 249 102	155 031 601	
	282 2009 203	275 468 117 S 155 327 101 R	130-154 30	330 370	2 1	155 249 102	155 031 601	
5-6" DLX	282 2009 303	275 468 117 S 155 327 101 R	130-154 30	330 370	2 1	155 249 102	155 031 601	155 325 102 L
7 1/2-6"	282 2019 210	275 468 119 S	270-324	330	1	275 411 102 S	155 031 601	
		275 468 117 S	130-154	330	1	275 406 121 M		
		155 327 109 R	45	370	1			
	282 2019 202	275 468 117 S	130-154	330	3	155 249 101	155 031 601	
		275 479 103 R (5)	15	370	3			
	282 2019 203	275 468 117 S 155 327 101 R 155 328 101 R	130-154 30 15	330 370 370	3 1 1	155 249 101	155 031 601	
7 1/2-6" DLX	282 2019 310	275 468 119 S	270-324	330	1	275 411 102 S	155 031 601	155 326 101 L
		275 468 117 S	130-154	330	1	275 406 121 M		
		155 327 109 R	45	370	1			
	282 2019 303	275 468 117 S 155 327 101 R 155 328 101 R	130-154 30 15	330 370 370	3 1 1	155 249 101	155 031 601	155 326 101 L
10-6"	282 2029 210	275 468 119 S	270-324	330	2	275 406 103 S	155 031 601	
		155 327 102 R	35	370	2	155 409 101 M		
	282 2029 202	275 468 117 S	130-154	330	4	155 249 103	155 031 601 (4)	
		275 479 103 R (5)	15	370	5			
	282 2029 203	275 468 117 S	130-154	330	4	155 249 103	155 031 601 (4)	
		155 327 101 R	30	370	2			
		155 328 101 R	15	370	1			
	282 2029 207	275 468 119 S 155 327 101 R 155 328 101 R	270-324 30 15	330 370 370	2 2 1	155 409 101	155 031 102 (6)	155 325 102 S
10-6" DLX	282 2029 310	275 468 119 S	270-324	330	2	275 406 103 S	155 031 601	155 326 102 L
		155 327 102 R	35	370	2	155 409 101 M		
	282 2029 303	275 468 117 S	130-154	330	4	155 249 103	155 031 601 (4)	155 326 102 L
		155 327 101 R	30	370	2			
		155 328 101 R	15	370	1			
	282 2029 307	275 468 119 S 155 327 101 R 155 328 101 R	270-324 30 15	330 370 370	2 2 1	155 409 101	155 031 102 (6)	155 326 102 L 155 325 102 S
15-6" DLX	282 2039 310	275 468 119 S	270-324	330	2	275 406 103 S	155 031 601	155 429 101 L
		155 327 109 R	45	370	3	155 409 102 M		
	282 2039 303	275 468 119 S	270-324	330	2	155 409 102	155 031 102 (6)	155 429 101 L
		155 327 101 R 155 328 101 R	30 15	370 370	4 1			155 325 102 S

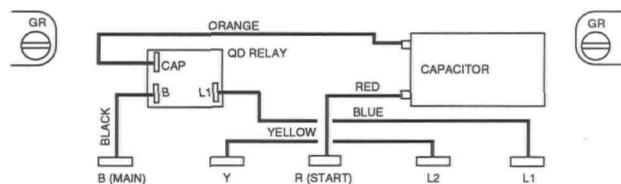
FOOTNOTES:

- (1) Lightning arrestor 150 814 902 suitable for all control boxes
- (2) S = Start M = Main L = Line R = Run
DLX = Deluxe control box with line contactor.
- (3) Capacitor and overload ass'y.
- (4) 2 required
- (5) These parts may be replaced as follows:

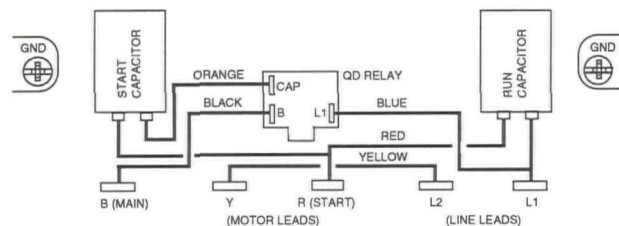
Old	New
275 479 102	155 328 102
275 479 103	155 328 101
275 479 105	155 328 103
275 481 102	155 327 102

- (6) May be replaced with 155 031 601 heavy duty relay.
- (7) For 208v systems or where line voltage is between 200v and 210 volts special low voltage relays are required. Use relay part 155 031 103 in place of part 155 031 102 or 155 031 602 in place of 155 031 601. Also use the next larger cable size than 230V tables for best operation. Boost transformers per page 12 are an alternative to special relays and cable.

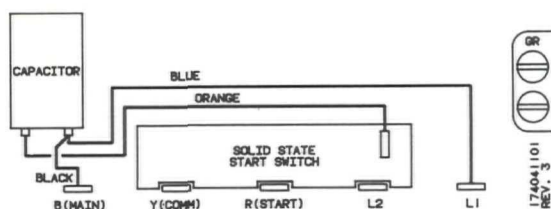
Maintenance — Single Phase Motors



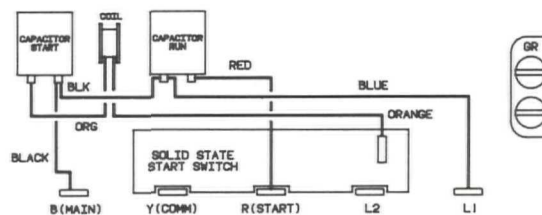
4"
1/3-1 HP QD RELAY
280 10-4 915
Sixth digit depends on HP



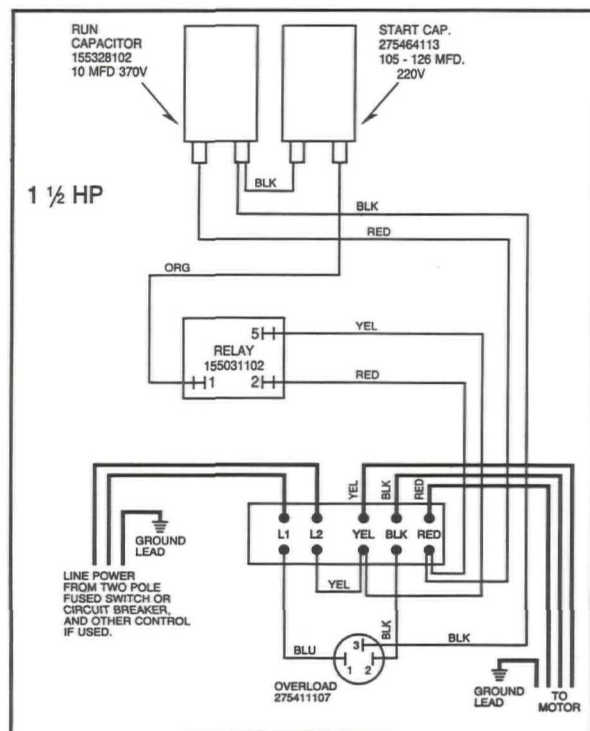
4"
1/2 - 1 HP CRC QD RELAY
282 40-5 015
Sixth digit depends on HP



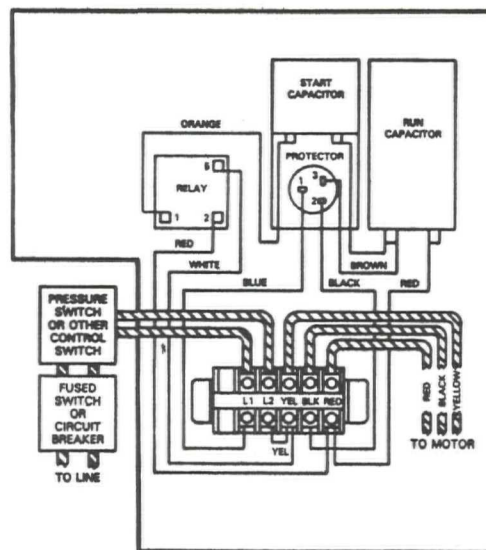
4"
1/3 - 1 HP QD
280 10-4 910
Sixth digit depends on HP



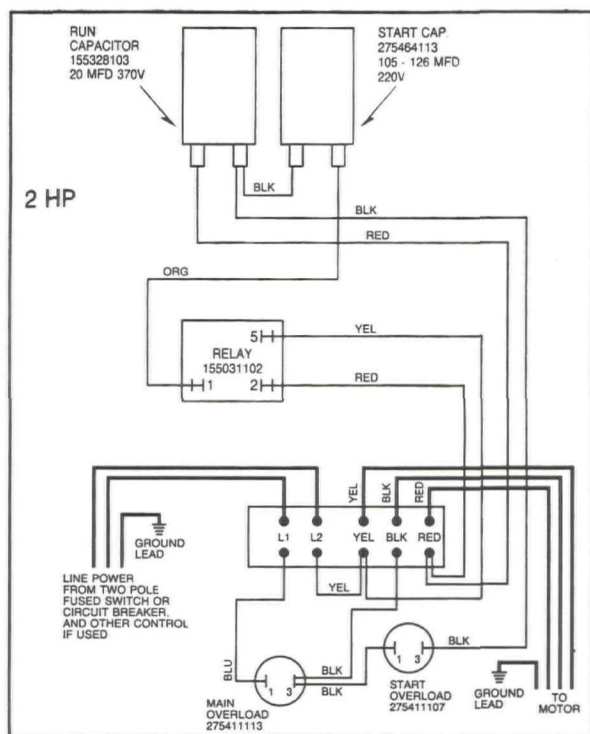
4"
1/2 - 1 HP CRC
282 40-5010
Sixth digit depends on HP



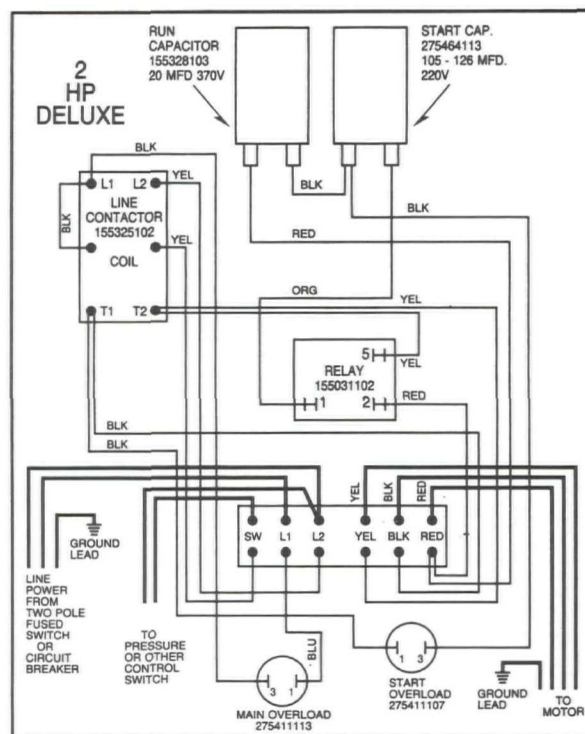
4" STANDARD
1 1/2 HP
282 300 8110



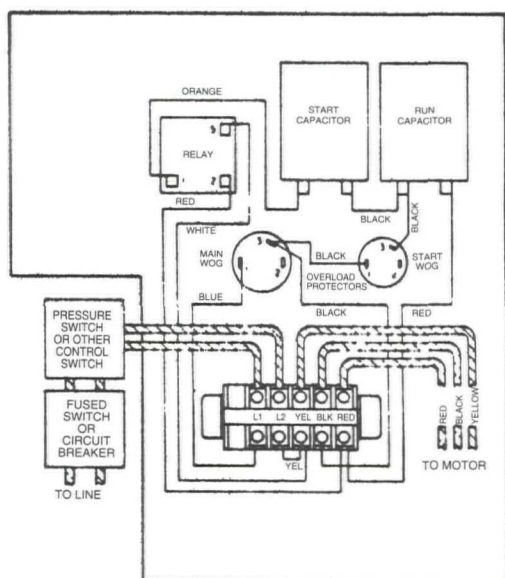
4"
1 1/2 HP
STANDARD
282 3007 103



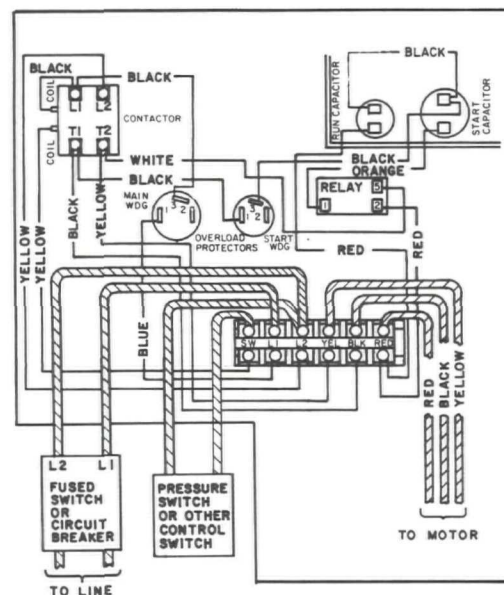
4" STANDARD
2 HP
282 301 8110



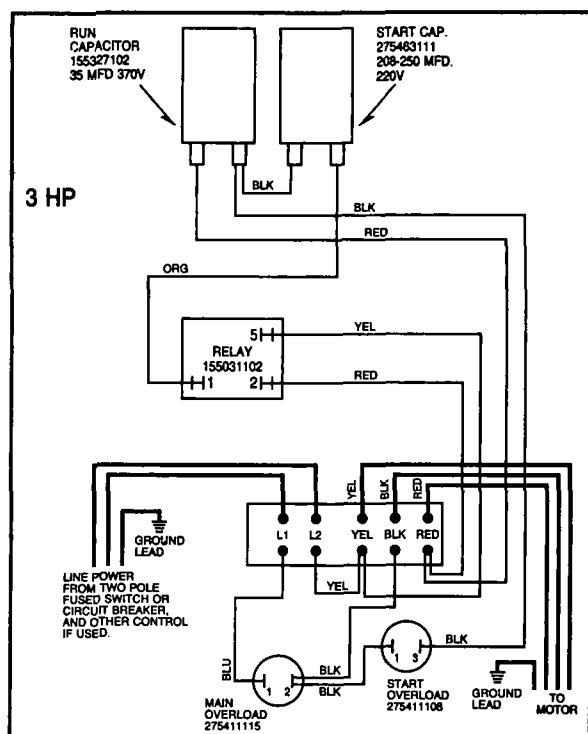
4" DELUXE
2 HP
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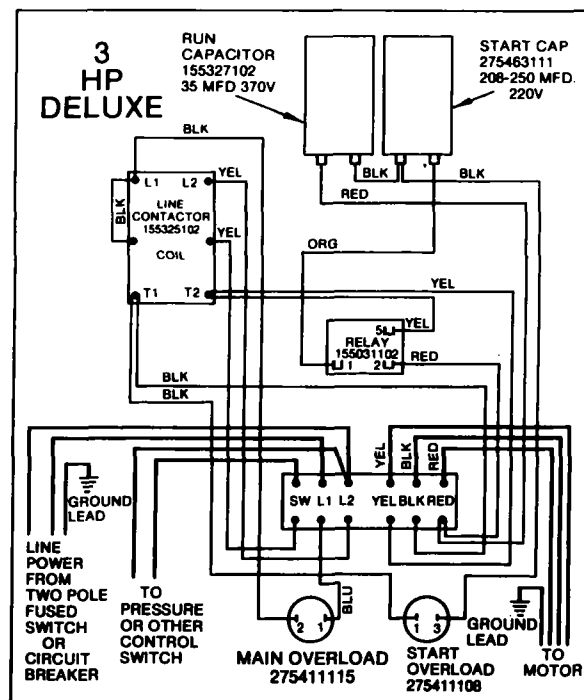
4"
2 AND 3 HP
STANDARD
282 3018 103
282 3028 103



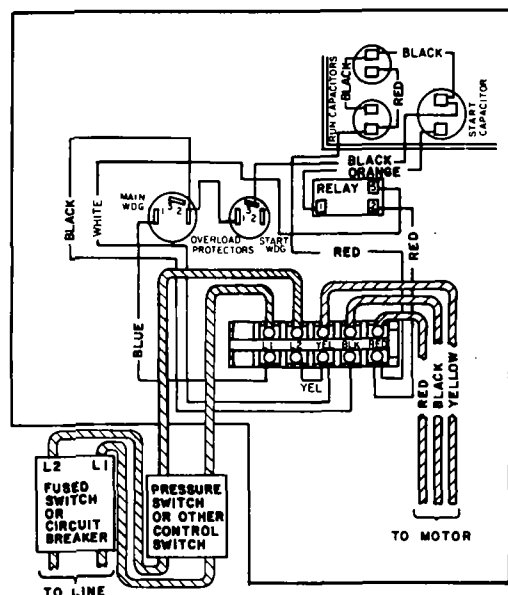
4"
2 AND 3 HP
DELUXE
282 3019 103
282 3029 103



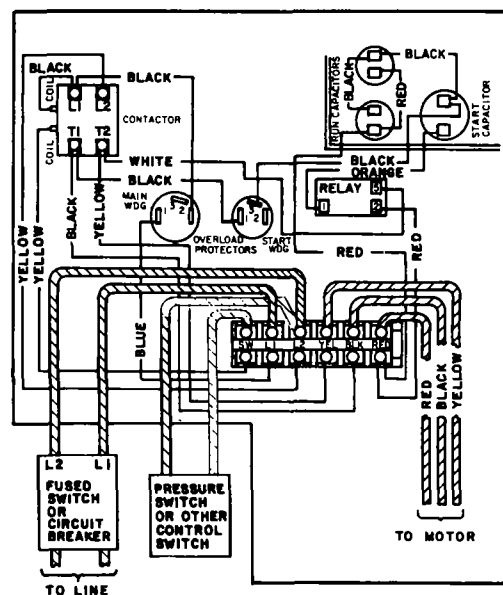
4" STANDARD
3 HP
282 302 8110



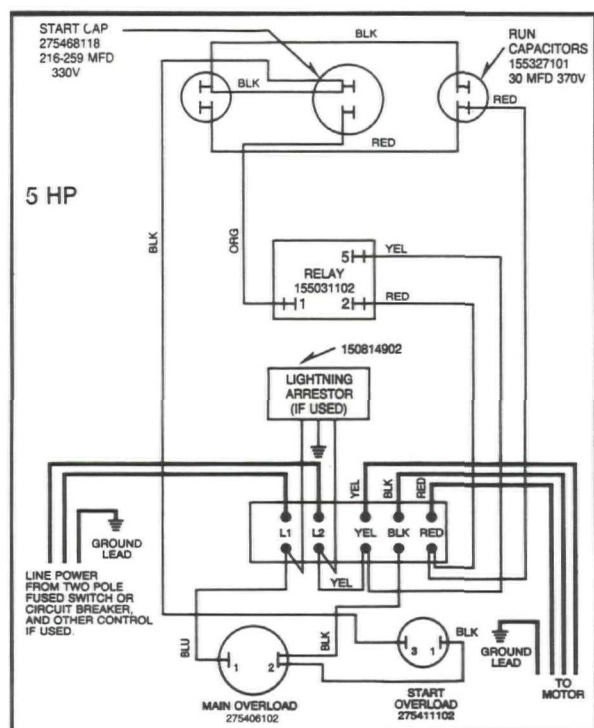
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3 HP
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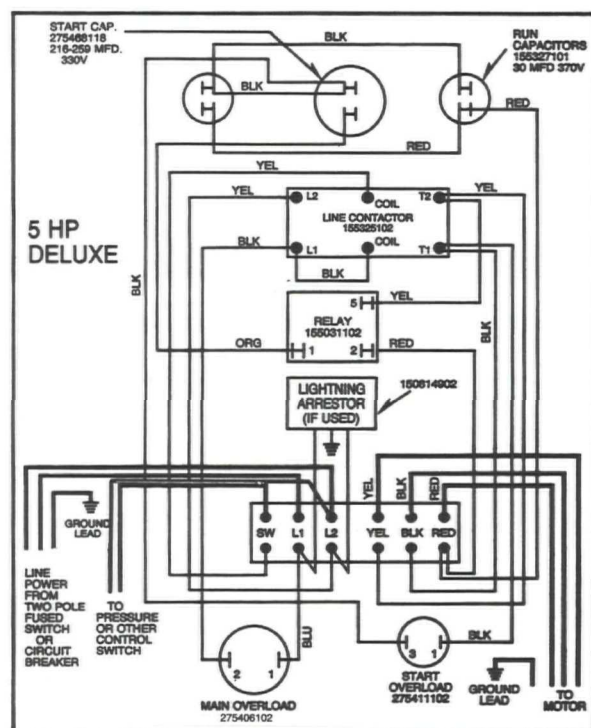
4"
5HP
STANDARD
282 1139 003



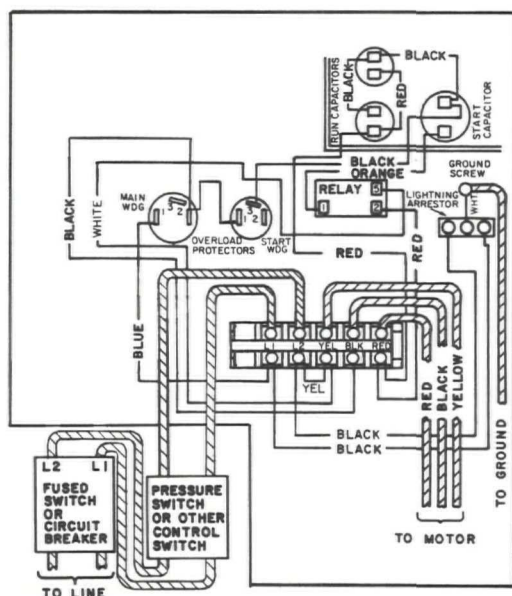
4"
5 HP
DELUXE
282 1139 103



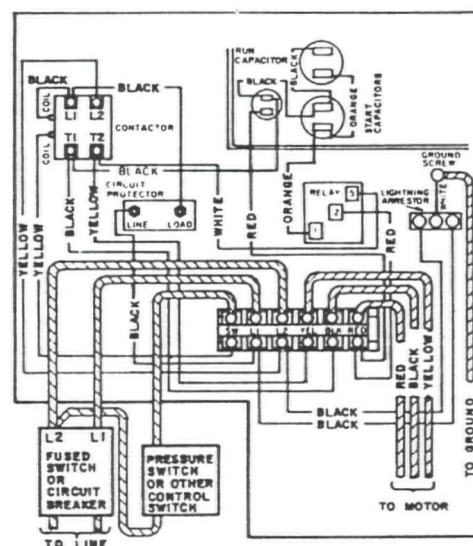
4" AND 6" STANDARD
5 HP
282 113 8110



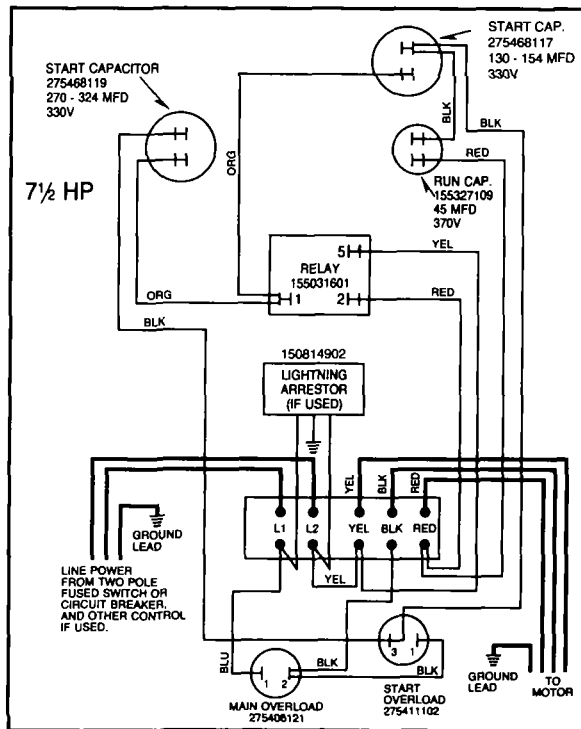
4" AND 6" DELUXE
5 HP
282 113 8310 or
282 113 9310



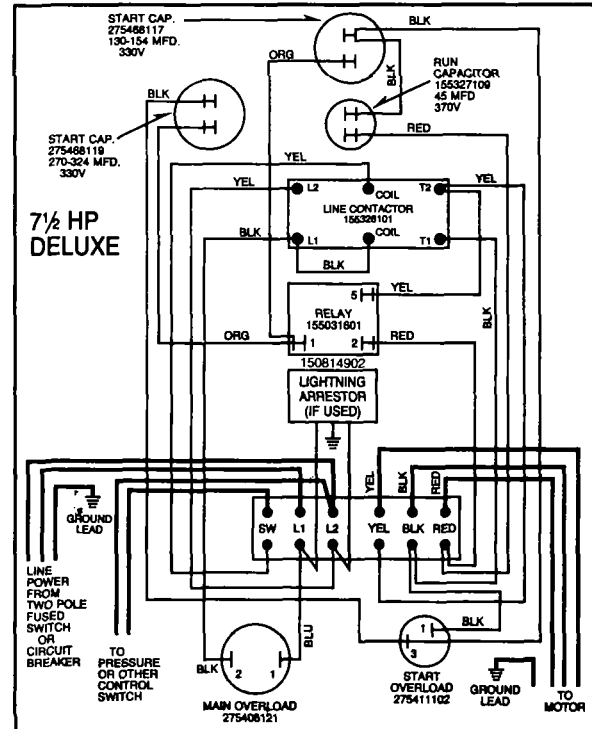
4"
5 HP
STANDARD
282 2009 203



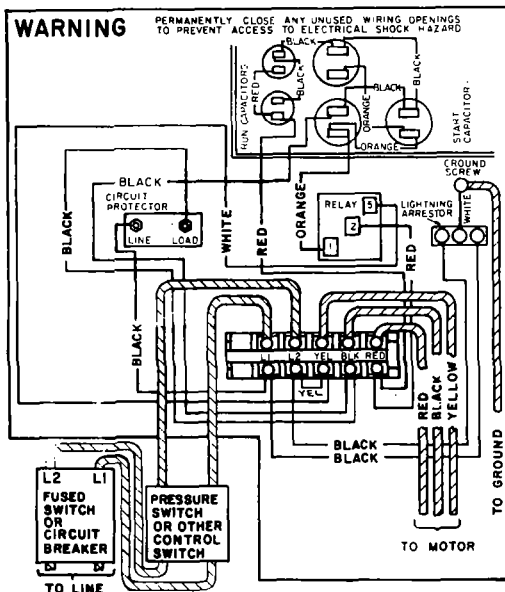
6"
5 HP
DELUXE
282 2009 303



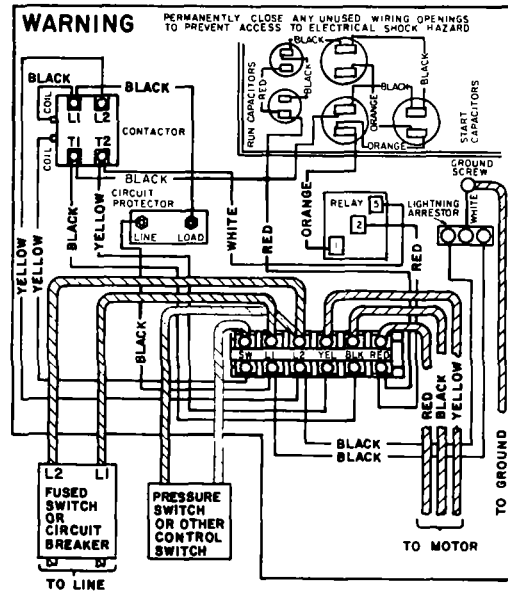
6" STANDARD
7 1/2 HP
282 201 9210



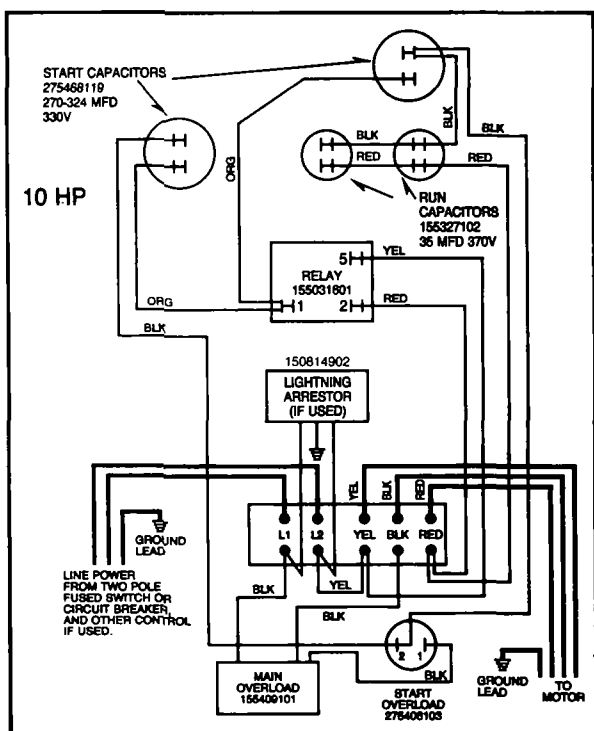
6" DELUXE
7 1/2 HP
282 201 9310



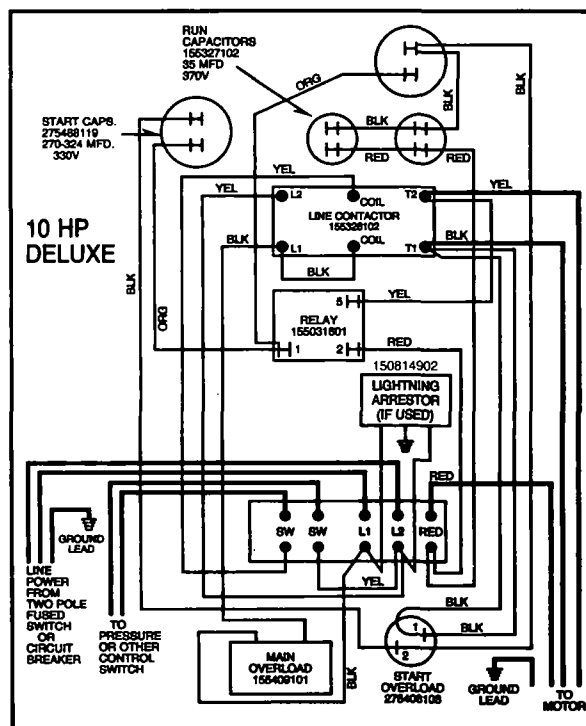
6"
7 1/2 HP
STANDARD
282 2019 203



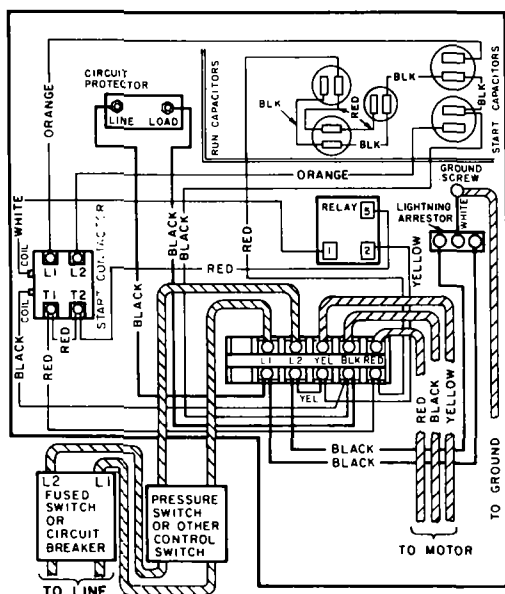
6"
7 1/2 HP
DELUXE
282 2019 303



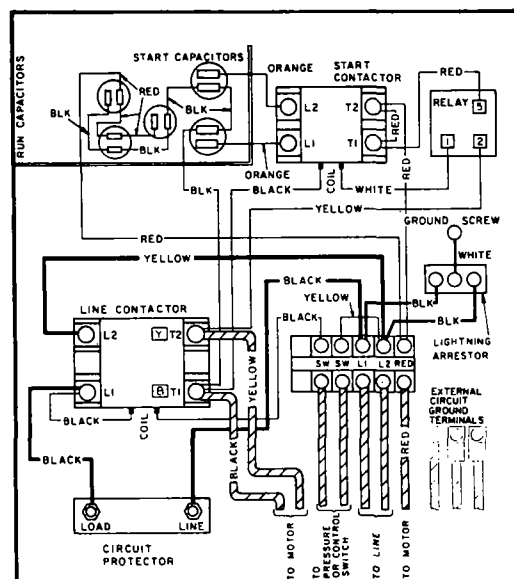
6" STANDARD
10 HP
282 202 9210



6" DELUXE
10 HP
282 202 9310

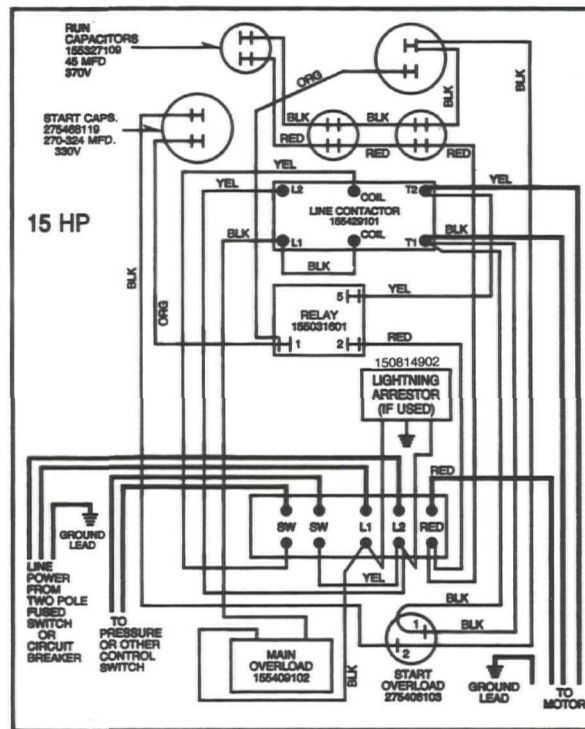


6" STANDARD
10 HP
282 202 9210

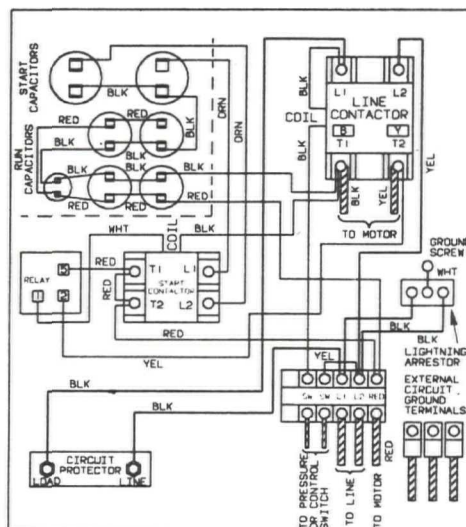


6" DELUXE
10 HP
282 202 9310

Maintenance — Single Phase Motors



6"
DELUXE
15 HP
282 203 9310



6"
15 HP
DELUXE
282 2039 303

NOTES

NOTES

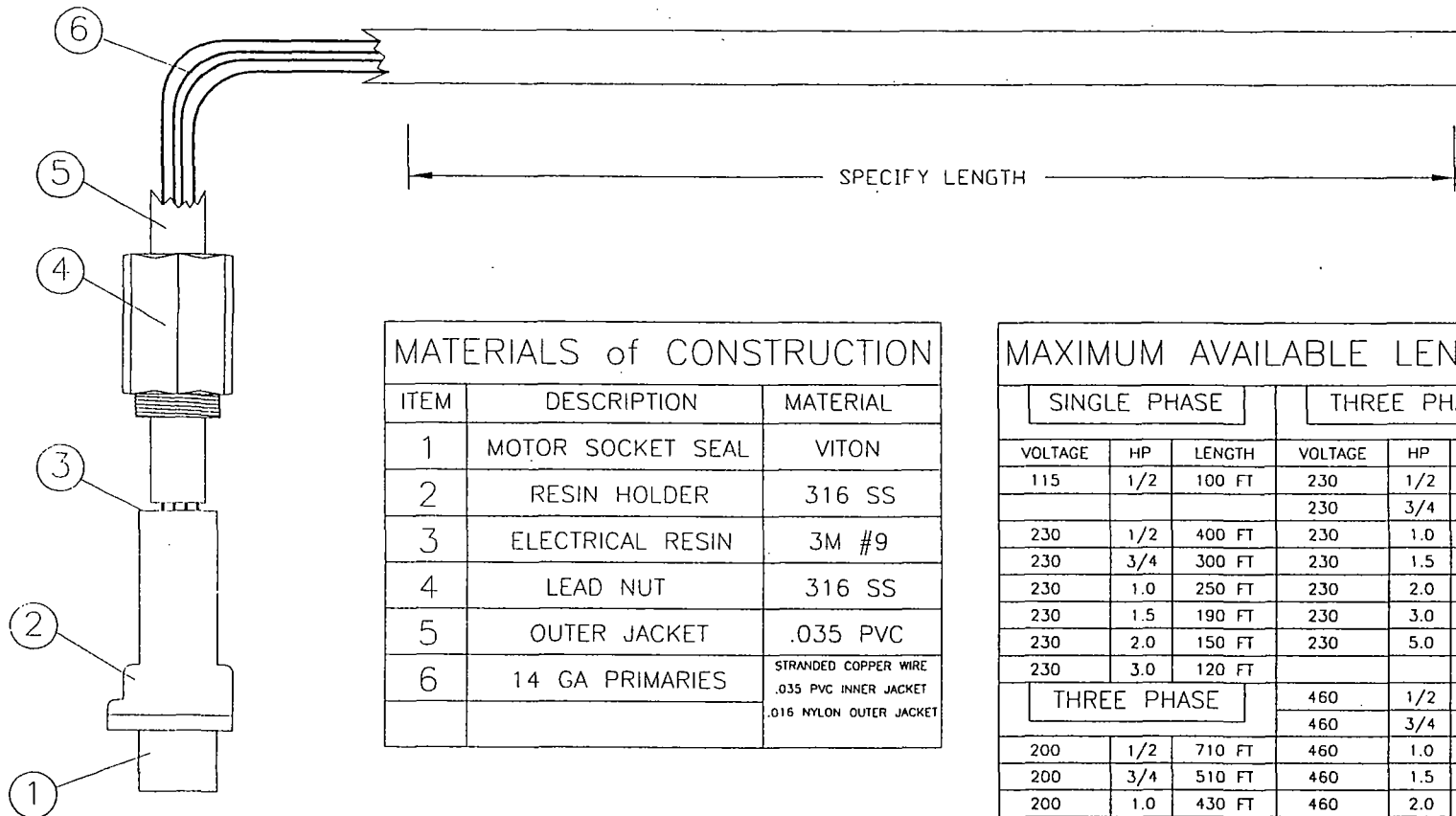
TOLL FREE HELP FROM A FRIEND

Phone Franklin's toll free SERVICE HOTLINE for answers to your installation questions on submersible pump motors. When you call, a Franklin expert will offer assistance in troubleshooting submersible systems and provide immediate answers to your motor application questions.

Franklin Electric SERVICE HOTLINE 800/348/2420



Franklin Electric
Bluffton, Indiana 46714



MATERIALS of CONSTRUCTION

ITEM	DESCRIPTION	MATERIAL
1	MOTOR SOCKET SEAL	VITON
2	RESIN HOLDER	316 SS
3	ELECTRICAL RESIN	3M #9
4	LEAD NUT	316 SS
5	OUTER JACKET	.035 PVC
6	14 GA PRIMARIES	STRANDED COPPER WIRE .035 PVC INNER JACKET .016 NYLON OUTER JACKET

MOTOR LEAD KITS ARE GENUINE FRANKLIN ELECTRIC COMPONENTS
CABLE IS CUSTOM MANUFACTURED TO PLC SPECIFICATIONS

MAXIMUM AVAILABLE LENGTHS

SINGLE PHASE			THREE PHASE		
VOLTAGE	HP	LENGTH	VOLTAGE	HP	LENGTH
115	1/2	100 FT	230	1/2	930
			230	3/4	670
230	1/2	400 FT	230	1.0	560
230	3/4	300 FT	230	1.5	420
230	1.0	250 FT	230	2.0	320
230	1.5	190 FT	230	3.0	240
230	2.0	150 FT	230	5.0	140
230	3.0	120 FT			
THREE PHASE			460	1/2	3770
			460	3/4	2730
200	1/2	710 FT	460	1.0	2300
200	3/4	510 FT	460	1.5	1700
200	1.0	430 FT	460	2.0	1300
200	1.5	310 FT	460	3.0	1000
200	2.0	240 FT	460	5.0	590
200	3.0	180 FT	460	7.5	420
200	5.0	110 FT	460	10.0	310

INFORMATION CONTAINED ON THIS SHEET IS INTENDED FOR PRIVATE USE ONLY
AND MAY NOT BE SHARED WITH ANY OTHER PARTIES THAN THOSE TO WHICH
THIS SHEET WAS ORIGINALLY SENT FOR QUALIFYING SPECIFICATIONS



PRODUCT LEVEL
CONTROL, INC.

MAIN OFFICES and PRODUCTION
11929 PORTLAND AV. S.
BURNSVILLE, MN. 55337
Tel: 612-707-9101
Fax: 612-707-1075

TOLERANCES ± .250"
DRAW. NUMB. SUBMERSIBLE POWER CABLE

CLIENT	PRODUCT LEVEL CONTRON INC.				DATE	11/16/90		
SITE	INTERNAL				BY	SCOTT PETERSON SYSTEMS ENGINEER		
TITLE-1	4" FRANKLIN SUBMERSIBLE MOTOR				PAGE	01	OF	01
TITLE-2	POWER SUPPLY LEAD (3-WIRE)				SCALE	NONE		
REVISION	01	BY	0			DATE	0	
REVISION	02	BY	0			DATE	0	
REVISION	03	BY	0			DATE	0	

Redi-Flo4

Stainless Steel Submersible Pumps for Environmental Applications

Installation and Operating Instructions



TABLE OF CONTENTS

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Pre-Installation Checklist	1	Start-Up	5-6
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Installation	2-3	Limited Warranty	15

Please leave these instructions with the pump for future reference.

GRUNDFOS®



Leaders in Pump Technology

SAFETY WARNING

Grundfos Stainless Steel Submersible Pumps

Your Grundfos Redi-Flo4 Environmental Pump is of the utmost quality. Combined with proper installation, your Grundfos pump will give you many years of reliable service.

To ensure the proper installation of the pump, carefully read the complete manual before attempting to install the pump.

Shipment Inspection

Examine the components carefully to make sure no damage has occurred to the pump-end, motor, cable or control box during shipment.

This Grundfos Redi-Flo4 Environmental Pump should remain in its shipping carton until it is ready to be installed. The carton is specially designed to protect it from damage. During unpacking and prior to installation, **make sure that the pump is not contaminated, dropped or mishandled.**

The motor is equipped with an electrical cable. **Under no circumstance should the cable be used to support the weight of the pump.**

You will find a loose data plate wired to the pump. It should be securely mounted at the well or attached to the control box.

Pre-Installation Checklist

Before beginning installation, the following checks should be made. They are all critical for the proper installation of this submersible pump.

A. Condition of the Well

If the pump is to be installed in a new well, the well should be fully developed and bailed or blown free of cuttings and sand. Dispose of discharged materials in accordance with the specific job site requirements. The stainless steel construction of the Redi-Flo4 Environmental Pump makes it resistant to abrasion; however, no pump, made of any material, can forever withstand the destructive wear that occurs when constantly pumping sandy groundwater.

Determine the maximum depth of the well, and the drawdown level at the pump's maximum capacity. Pump selection and setting depth should be based on this data.

The inside diameter of the well casing should be checked to ensure that it is not smaller than the size of the pump and motor.

Pre-Installation Checklist

B. Condition of the Water

Redi-Flo4 pumps are designed for pumping cold groundwater that is free of air or gases. Decreased pump performance and life expectancy can occur if the groundwater is not cold or contains air or gases.

C. Installation Depth

Pumping sand or well sediment can occur when the pump motor is installed lower than the top of the well screen or within five feet of the well bottom. This can reduce the performance and life expectancy of the pump and should be avoided.

If the pump is to be installed in a lake, containment pond, tank or large diameter well, the water velocity passing over the motor must be sufficient to ensure proper motor cooling. The minimum recommended water flow rates which ensure proper cooling are listed in Table A.

D. Electrical Supply

The motor voltage, phase and frequency indicated on the motor nameplate should be checked against the actual electrical supply.

Wire Cable Type

The wire cable used between the pump and control box or panel should be approved for submersible pump applications. The conductor insulation should have a continuous Teflon® jacket with no splices and must be suitable for use with submersible pumps.

Installation

The riser pipe or hose should be properly sized and selected based on estimated flow rates and friction-loss factors.

A back-up wrench should be used when the riser pipe is attaching a riser pipe or metallic nipple to the pump. The pump should only be gripped by the flats on the top of the discharge chamber. **The body of the pump, cable guard or motor should not be gripped under any circumstance.**

If Steel Riser Pipe Is Used:

An approved pipe thread compound should be used on all joints. Make sure the joints are adequately tightened in order to resist the tendency of the motor to loosen the joints when stopping and starting.

When tightened, the first section of the riser pipe must not come in contact with the check valve retainer in the discharge chamber of the pump.

Installation

After the first section of the riser pipe has been attached to the pump, the lifting cable or elevator should be clamped to the pipe. **Do not clamp the pump.** When raising the pump and riser section, be careful not to place bending stress on the pump by picking it up by the pump-end only.

Make sure that the electrical cables are not cut or damaged in any way when the pump is being lowered in the well.

The drop cable should be secured to the riser pipe at frequent intervals to prevent sagging, looping or possible cable damage.

If Plastic or Flexible Riser Pipe Is Used:

Use the correct compound recommended by the pipe manufacturer or specific job specifications. Besides making sure that joints are securely fastened, the use of a torque arrester is recommended when using these types of pipe.

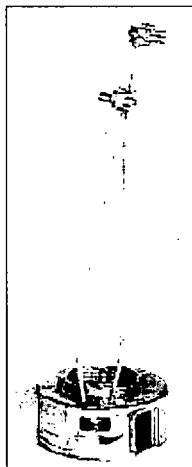
Do not connect the first plastic or flexible riser section directly to the pump. Always attach a metallic nipple or adapter into the discharge chamber of the pump. When tightened, the threaded end of the nipple or adapter must not come in contact with the check valve retainer in the discharge chamber of the pump.

The drop cable should be secured to the riser pipe at frequent intervals using an approved clip or tape to prevent sagging, looping and possible cable damage.

IMPORTANT - Plastic and flexible pipe tend to stretch under load. This stretching must be taken into account when securing the cable to the riser pipe. Leave enough slack between clips or taped points to allow for this stretching. This tendency for plastic and flexible pipe to stretch will also affect the calculation of the pump setting depth. If the depth setting is critical, check with the manufacturer of the pipe to determine how to compensate for pipe stretch.

When these types of pipe are used, it is recommended that a safety cable be attached to the pump to lower and raise it. The discharge piece of Redi-Flo4 submersibles is designed to accommodate this cable (Figure 4).

FIGURE 4



Protect the Well from Contamination

While installing the pump, proper care should be used not to introduce foreign objects or contaminants into the well. The well should be finished off above grade to protect against surface water from entering the well, causing contamination.

NOTE: Teflon® is a registered trademark of DuPont.

WARNING: To reduce the risk of electrical shock during operation of this pump requires the provision of acceptable grounding. If the means of connection to the supply connected box is other than grounded metal conduit, ground the pump back to the service by connecting a copper conductor, at least the size of the circuit supplying the pump, to the grounding screw provided within the wiring compartment.

All electrical work should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.

Verification of the electrical supply should be made to ensure the voltage, phase and frequency match that of the motor. Motor voltage, phase, frequency and full-load current information can be found on the nameplate attached to the motor. Motor electrical data can be found in Table C.

If voltage variations are larger than $\pm 10\%$, do not operate the pump.

Direct on-line starting is used due to the extremely fast run-up time of the motor (0.1 second maximum), and the low moment of inertia of the pump and motor. Direct on-line starting current (locked rotor amp) is between 4 and 6.5 times the full-load current.

Engine-Driven Generators

If the Redi-Flo4 pump is going to be operated using an engine driven generator, we suggest the manufacturer of the generator be contracted to ensure the proper generator is selected and used. See Table B for generator sizing guide.

Control Box/Panel Wiring

Single-phase motors must be connected as indicated in the motor control box. A typical single-phase wiring diagram using a Grundfos control box is shown (Figure 5-A).

High Voltage Surge Arresters

A high voltage surge arrester should be used to protect the motor against lightning and switching surges. The correct voltage-rated surge arrester should be installed on the supply(line) side of the control box (Figure 5-B). **The arrester must be grounded in accordance with the National Electric Code, local codes and regulations.**

FIGURE 5-A

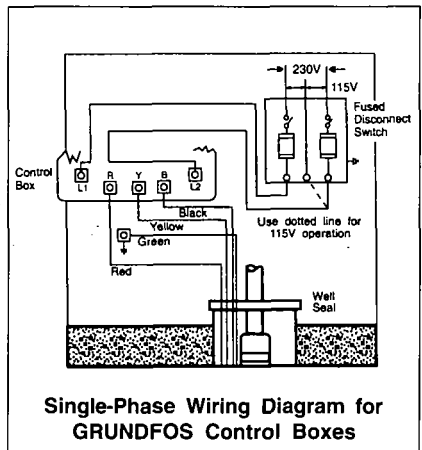
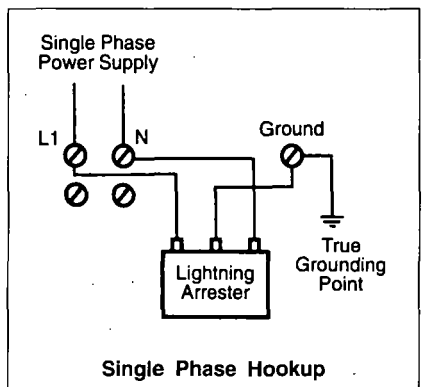


FIGURE 5-B



Electrical

Control Box and Surge Arrester Grounding

The control box shall be permanently grounded in accordance with the National Electrical Code and local codes or regulations. The ground wire should be a bare copper conductor at least the same size as the drop cable wire size. The ground wire should be run as short a distance as possible and be securely fastened to a true grounding point.

True grounding points are considered to be: a grounding rod driven into the water strata, steel well casing submerged into the water lower than the pump setting level, and steel discharge pipes without insulating couplings. If plastic discharge pipe and well casing are used, a properly sized bare copper wire should be connected to a stud on the motor and run to the control panel. Do not ground to a gas supply line. Connect the grounding wire to the ground point first and then to the terminal in the control box or panel.

Wiring Checks

Before making the final wiring connections of the drop cable to the control box terminal, it is a good practice to check the insulation resistance to ensure that the cable is good. Measurements for a new installation must be at least 1,000,000 ohm. Do not start the pump if the measurement is less than this. If it is higher, finish wiring and verify that all electrical connections are made in accordance with the wiring diagram. Check to ensure the control box and high voltage surge arrester have been grounded.

Start-Up

After the pump has been set into the well and the wiring connections have been made, the following procedures should be performed:

- A. Attach a temporary horizontal length of pipe with installed gate valve to the riser pipe.
- B. If required, make provisions to capture discharged fluids for disposal.
- C. Adjust the gate valve one-third open.
- D. Start the pump and let it operate until the water runs clear of sand and silt.
- E. As the water clears, slowly open the gate valve in small increments until the desired flow rate of clear water is reached. The pump should not be operated beyond its maximum flow rating and should not be stopped until the groundwater runs clear.
- F. If the groundwater is clean and clear when the pump is first started, the valve should still be opened until the desired flow rate is reached.
- G. Disconnect the temporary piping arrangements and complete the final piping connections.
- H. **Under no circumstances should the pump be operated for any prolonged period of time with the discharge valve closed.** This can result in motor damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.
- I. Start the pump and test the system. Check and record the voltage and current draw on each motor lead.

Operation

- A. The pump and system should be periodically checked for water quantity, pressure, drawdown, periods of cycling, and operation of controls. **Under no circumstances should be the pump be operated for any prolonged periods of time with the discharge valve closed.** This can result in motor and pump damage due to overheating. A properly sized relief valve should be installed at the well head to prevent the pump from running against a closed valve.
- B. If the pump fails to operate, or there is a loss of performance, refer to Troubleshooting, Section 7.

Troubleshooting

The majority of problems that develop with submersible pumps are electrical, and most of these problems can be corrected without pulling the pump from the well. The following charts cover most of the submersible service work. As with any troubleshooting procedure, start with the simplest solution first; always make all the above-ground checks before pulling the pump from the well.

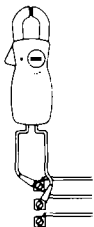
Usually only two instruments are needed – a combination voltmeter/ammeter, and an ohmmeter. These are relatively inexpensive and can be obtained from most water systems suppliers.

WHEN WORKING WITH ELECTRICAL CIRCUITS, USE CAUTION TO AVOID ELECTRICAL SHOCK. It is recommended that rubber gloves and boots be worn and that care is taken to have metal control boxes and motors grounded to power supply ground or steel drop pipe or casing extending into the well. **WARNING:** Submersible motors are intended for operation in a well. When not operated in a well, failure to connect motor frame to power supply ground may result in serious electrical shock.

Troubleshooting

Preliminary Tests

SUPPLY VOLTAGE



How to Measure

By means of a voltmeter, which has been set to the proper scale, measure the voltage at the control box. On single-phase units, measure between line and neutral.

What it Means

When the motor is under load, the voltage should be within $\pm 10\%$ of the nameplate voltage. Larger voltage variation may cause winding damage.

Large variations in the voltage indicate a poor electrical supply and the pump should not be operated until these variations have been corrected.

If the voltage constantly remains high or low, the motor should be changed to the correct supply voltage.

CURRENT MEASUREMENT



How to Measure

By use of an ammeter, set on the proper scale, measure the current on each power lead at the control box. See the Electrical Data, Table C, for motor amp draw information.

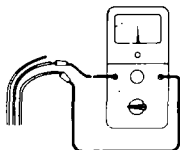
Current should be measured when the pump is operating at a constant discharge pressure with the motor fully loaded.

What it Means

If the amp draw exceeds the listed service factor amps (SFA), check for the following:

1. Loose terminals in control box or possible cable defect. Check winding and insulation resistances.
3. Too high or low supply voltage.
4. Motor windings are shorted.
5. Pump is damaged causing a motor overload.

WINDING RESISTANCE



How to Measure

Turn off power and disconnect the drop cable leads in the control box. Using an ohmmeter, set the scale selectors to Rx1 for values under 10 ohms and Rx10 for values over 10 ohms.

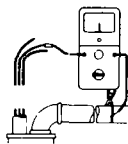
Zero-adjust the meter and measure the resistance between leads. Record the values.

Motor resistance values can be found in Electrical Data, Table C. Cable resistance values are in Table D.

What it Means

If all the ohm values are normal, and the cable colors correct, the windings are not damaged. If any one ohm value is less than normal, the motor may be shorted. If any one ohm value is greater than normal, there is a poor cable connection or joint. The windings or cable may also be open. If some of the ohm values are greater than normal and some less, the drop cable leads are mixed. To verify lead colors, see resistance values in Electrical Data, Table C.

INSULATION RESISTANCE



How to Measure

Turn off power and disconnect the drop cable leads in the control box. Using an ohm or mega ohmmeter, set the scale selector to Rx 100K and zero-adjust the meter.

Measure the resistance between the lead and ground (discharge pipe or well casing, if steel).

What it Means

For ohm values, refer to table below. Motors of all Hp, voltage, phase and cycle duties have the same value of insulation resistance.

Troubleshooting Chart

OHM VALUE	MEGAOHM VALUE	CONDITION OF MOTOR AND LEADS
2,000,000 (or more)	2.0	Motor not yet installed: New Motor.
1,000,000 (or more)	1.0	Used motor which can be reinstalled in the well.
500,000 - 1,000,000	0.5 - 1.0	Motor in well (Ohm readings are for drop cable plus motor): A motor in reasonably good condition.
20,000 - 500,000	0.02 - 0.5	A motor which may have been damaged by lightning or with damaged leads. Do not pull the pump for this reason.
10,000 - 20,000	0.01 - 0.02	A motor which definitely has been damaged or with damaged cable. The pump should be pulled and repairs made to the cable or the motor replaced. The motor will still operate, but probably not for long.
less than 10,000	0 - 0.01	A motor which has failed or with completely destroyed cable insulation. The pump must be pulled and the cable repaired or the motor replaced. The motor will not run in this condition.

A. Pump Does Not Run

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. No power at pump panel.	Check for voltage at panel.	If no voltage at panel, check feeder panel for tripped circuits.
2. Fuses are blown or circuit breakers are tripped.	Remove fuses and check for continuity with ohmmeter.	Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, the electrical installation and motor must be checked.
3. Defective controls.	Check all safety and pressure switches for operation. Inspect contacts in control devices.	Replace worn or defective parts.
4. Motor and/or cable are defective.	Turn off power. Disconnect motor leads from control box. Measure the lead to lead resistances with the ohmmeter (Rx1). Measure lead to ground values with ohmmeter (Rx100K). Record measured values.	If open motor winding or ground is found, remove pump and recheck values at the surface. Repair or replace motor or cable.
5. Defective capacitor.	Turn off the power, then discharge capacitor. Disconnect leads and check with an ohmmeter (Rx100K). When meter is connected, the needle should jump forward and slowly drift back.	If there is no needle movement, replace the capacitor.

Troubleshooting Chart

B. Pump Runs But Does Not Deliver Water

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Groundwater level in well is too low or well is collapsed.	Check well draw-down.	Lower pump if possible. If not, throttle discharge valve and install water level control.
2. Integral pump check valve is blocked.	Install pressure gauge, start pump, gradually close the discharge valve and read pressure at shut-off. After taking reading, open valve to its previous position. Convert PSI to feet. (For water: $\text{PSI} \times 2.31 \text{ ft/PSI} = \text{ft.}$), and add this to the total vertical distance from the pressure gauge to the water level in the well while the pump is running. Refer to the specific pump curve for the shut-off head for that pump model. If the measured head is close to the curve, pump is probably OK.	If not close to the pump curve, remove pump and inspect discharge section. Remove blockage, repair valve and valve seat if necessary. Check for other damage. Rinse out pump and reinstall.
3. Inlet strainer is clogged.	Same as B.2 above.	If not close to the pump curve, remove pump and inspect. Clean strainer, inspect integral check valve for blockage, rinse out pump and reinstall.
4. Pump is damaged.	Same as B.2 above.	If damaged, repair as necessary. Rinse out pump and re-install.

C. Pump Runs But at Reduced Capacity

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Draw-down is larger than anticipated.	Check drawdown during pump operation.	Lower pump if possible. If not, throttle discharge valve and install water level control.
2. Discharge piping or valve leaking.	Examine system for leaks.	Repair leaks.
3. Pump strainer or check valve are clogged.	Remove pump and inspect.	Clean, repair, rinse out pump and reinstall.
4. Pump worn.	Same as B.2 above.	If not close to pump curve, remove pump and inspect.

D. Pump Cycles Too Much

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. Pressure switch is not properly adjusted or is defective.	Check pressure setting on switch and operation. Check voltage across closed contacts.	Re-adjust switch or replace if defective.
2. Level control is not properly set or is defective.	Check setting and operation.	Re-adjust setting (refer to manufacturer data.) Replace if defective.
3. Plugged snifter valve or bleed orifice.	Examine valve and orifice for dirt or corrosion.	Clean and/or replace if defective.

Troubleshooting Chart

E. Fuses Blow or Circuit Breakers Trip

POSSIBLE CAUSES	HOW TO CHECK	HOW TO CORRECT
1. High or low voltage.	Check voltage at pump panel. If not within $\pm 10\%$, check wire size and length of run to pump panel.	If wire size is correct, contact power company. If not, correct and/or replace as necessary.
2. Control box wiring and components.	Check that control box parts match the parts list. Check to see that wiring matches wiring diagram. Check for loose or broken wires or terminals.	Correct as required.
3. Defective capacitor.	Turn off power and discharge capacitor. Check using an ohmmeter (Rx100K). When the meter is connected, the needle should jump forward and slowly drift back.	If no meter movement, replace the capacitor.
4. Starting relay (Franklin single-phase motors only).	Check resistance of relay coil with an ohmmeter (Rx1000K). Check contacts for wear.	Replace defective relay.

Technical Data

Table A

Minimum Water Flow Requirements for Submersible Pump Motors

MOTOR DIAMETER	CASING OR SLEEVE I.D. IN INCHES	MIN. FLOW PAST THE MOTOR (GPM)
4"	4	1.2
	5	7
	6	13
	7	21
	8	30

NOTES:

1. A flow inducer or sleeve must be used if the water enters the well above the motor or if there is insufficient water flow past the motor.
2. The minimum recommended water velocity over 4" motors is 0.25 feet per second.

Table B

Guide for Engine-Driven Generators in Submersible Pump Applications

MOTOR HP	MINIMUM KILOWATT RATING OF GENERATOR FOR THREE-WIRE SUBMERSIBLE PUMP MOTORS	
	EXTERNALLY REGULATED GENERATOR	INTERNALLY REGULATED GENERATOR
0.33 HP	1.5 KW	1.2 KW
0.50	2.0	1.5
0.75	3.0	2.0
1.0	4.0	2.5
1.5	5.0	3.0

NOTES:

1. Table is based on typical 80°C rise continuous duty generators with 35% maximum voltage dip during start-up of single phase motors.
2. Contact the manufacturer of the generator to assure the unit has adequate capacity to run the submersible motor.
3. If the generator rating is in KVA instead of kilowatts, multiply the above ratings by 1.25 to obtain KVA.

Technical Data

Table C

Electrical Data – 60 Hz Submersible Pump Motors

GRUNDFOS MOTORS

HP	PH	VOLT	SER. FACT.	CIRC. BRK. OR STD. FUSE	DUAL ELEMENT FUSE	AMPÉRAGE			FULL LOAD		LINE-TO-LINE RESISTANCE (OHMS)		KVA CODE **	MAX. THRUST (LBS)	GRUNDFOS PART NO.
						FULL LOAD	LOCK ROTOR	S.F. AMPS	EFF.	POWER FACTOR	Bik-Yel	Red-Yel			

Delta

4-Inch, Single Phase, 2-Wire Motors (control box not required)

1/3	1	230	1.75	15	5	3.4	25.7	4.6	59.0	77.0	6.8-8.2		S	770	79.952301
1/2	1	230	1.60	15	7	4.5	34.5	6.0	62.0	76.0	5.2-6.3		R	770	79.952302
3/4	1	230	1.50	20	9	6.9	40.5	8.4	62.0	75.0	3.2-3.8		N	770	79.952303
1	1	230	1.40	25	12	8.0	48.4	9.8	63.0	82.0	2.5-3.1		M	770	79.952304
1-1/2	1	230	1.30	35	15	10.0	62.0	13.1	64.0	85.0	1.9-2.3		L	770	79.952305

4-Inch, Single Phase, 3-Wire Motors

1/3	1	230	1.75	15	5	3.4	14.0	4.6	59.0	77.0	6.8-8.3	17.3-21.1	L	770	79.453301
1/2	1	230	1.60	15	7	4.5	21.5	6.0	62.0	76.0	4.7-5.7	15.8-19.6	L	770	79.453302
3/4	1	230	1.50	20	9	6.9	31.4	8.4	62.0	75.0	3.2-3.9	14-17.2	L	770	79.453303
1	1	230	1.40	25	12	8.0	38.0	9.8	63.0	82.0	2.6-3.1	10.3-12.5	K	770	79.453304
1-1/2	1	230	1.30	35	15	9.4	45.9	11.6	69.0	89.0	1.9-2.3	7.8-9.6	H	770	79.453305

FRANKLIN MOTORS

(refer to the Franklin Submersible Motors Application Maintenance Manual)

Technical Data

Table D

Total Resistance of Drop Cable (OHMS)

The values shown in this table are for copper conductors. Values are for the total resistance of drop cable from the **control box to the motor and back**.

To determine the resistance:

1. Disconnect the drop cable leads from the control box.
2. Record the size and length of drop cable.
3. Determine the cable resistance from the table.
4. Add drop cable resistance to motor resistance. Motor resistances can be found in the Electrical Data Chart, Table C.
5. Measure the resistance between each drop cable lead using an ohmmeter. Meter should be set on Rx1 and zero-balanced for this measurement.
6. The measured values should be approximately equal to the calculated values.

Wire Resistances

DISTANCE FROM CONTROL BOX TO PUMP MOTOR (FT.)	12 AWG WIRE RESISTANCE (OHMS)	14 AWG WIRE RESISTANCE (OHMS)
10	0.03	0.05
20	0.06	0.10
30	0.10	0.15
40	0.13	0.21
50	0.16	0.26
60	0.19	0.31
70	0.23	0.36
80	0.26	0.41
90	0.29	0.46
100	0.32	0.51
110	0.36	0.57
120	0.39	0.62
130	0.42	0.67
140	0.45	0.72
150	0.49	0.77
160	0.52	0.82
170	0.55	0.87
180	0.58	0.93
190	0.62	0.98
200	0.65	1.03

Notes

LIMITED WARRANTY

Redi-Flo4 Environmental Pumps manufactured by GRUNDFOS PUMPS CORPORATION (GRUNDFOS) are warranted to the original user only to be free of defects in material and workmanship for a period of 18 months from date of installation, but not more than 24 months from date of manufacture. GRUNDFOS' liability under this warranty shall be limited to repairing or replacing at GRUNDFOS' option, without charge, F.O.B. GRUNDFOS' factory or authorized service station, any product of GRUNDFOS' manufacture. GRUNDFOS will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by GRUNDFOS are subject to the warranty provided by the manufacturer of said products and not by GRUNDFOS' warranty. GRUNDFOS will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with GRUNDFOS' printed installation and operating instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS' products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact GRUNDFOS or an authorized service station for instructions. Any defective product to be returned to GRUNDFOS or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

GRUNDFOS®



Leaders in Pump Technology

Grundfos Pumps Corporation • 3131 N. Business Park Avenue • Fresno, CA 93727

Customer Service Centers: Allentown, PA • Fresno, CA

Phone: (800) 333-1366 • Fax: (800) 333-1363

Canada: Oakville, Ontario • Mexico: Apodaca, N.D.



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GRUNDFOS

Redi-Flow 4

SUBMERSIBLE PUMPS FOR ENVIRONMENTAL APPLICATIONS

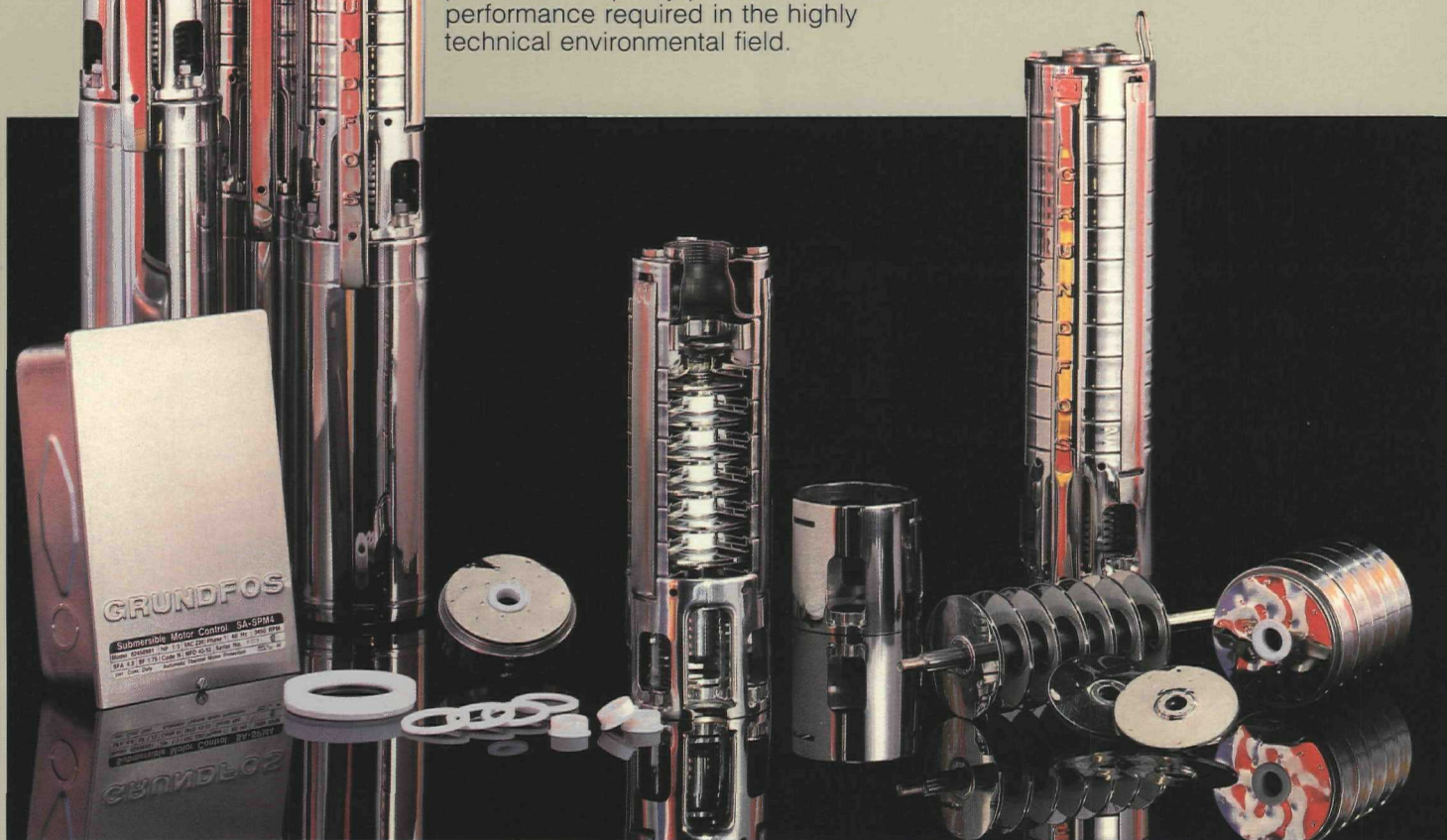




Grundfos Sets the Industry Standard ...Redi-Flo4 Stainless Steel and Teflon

In an industrialized world such as ours, large volumes of fuels, oils and other hydrocarbons, as well as industrial wastes and toxic contaminants are routinely moved and stored. Spills, seepage, leaks and the accumulation of agrichemical products contribute daily to the contamination of our underground water supplies.

Environmental monitoring and clean-up operations require the best equipment available. For years hydrogeologists and environmental engineers have recognized the unique qualities of Grundfos stainless steel submersibles and have used them extensively in environmental applications. With their automated design and manufacturing techniques, Grundfos engineers have combined their time-proven stainless steel submersible with the environmental requirement of Teflon® bearings and seals. The resulting 4-inch **Redi-Flo4** submersible features the combination of stainless steel and Teflon® as its **standard materials of construction**. With off-the-shelf availability in sizes to 32 gpm, **Redi-Flo4** provides the quality product and reliable performance required in the highly technical environmental field.



GRUNDFOS ENVIRONMENTAL PUMPS

with Quality and Performance[®] Submersible Pumps

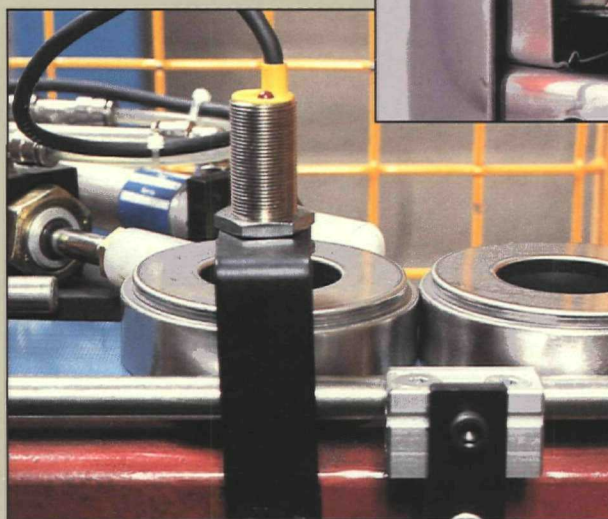
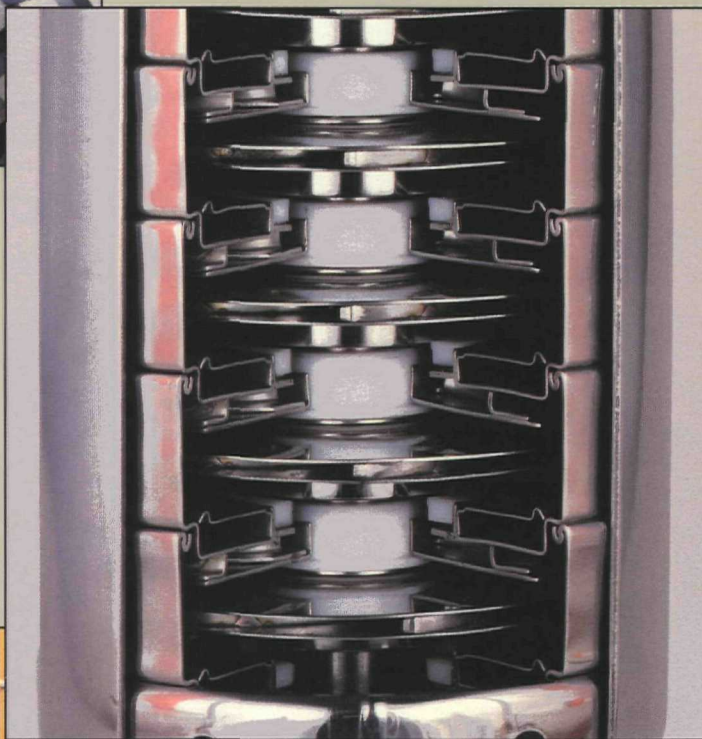


"Computer assisted design allows specified performance without compromising materials of construction..."

Through the application of modern CAD/CAM design technology, Grundfos engineers have been able to overcome the difficulties of fabricating stainless steel while maintaining the benefits of durable construction and top performance.

"Redi-Flo4 submersibles meet government guidelines for sample integrity..."

Stainless steel and Teflon[®] are the only materials used in Grundfos Redi-Flo4 submersible pump ends. Bowls, impellers, guide vanes, pump shaft, check valve... even the nuts, bolts and washers are stainless steel. With Teflon[®] bearings, seals, and motor leads, the Redi-Flo4 is the industry's choice in 4-inch submersible pumps.



"Automated manufacturing techniques form stainless steel into state-of-the-art environmental pumps..."

Computerized manufacturing processes form single sheets of stainless steel into fully tested stainless steel and Teflon[®] submersible pumps. With rigid quality assurance procedures combined with the most inert materials available, Redi-Flo4 submersibles meet the strict specifications of environmental engineers.



Grundfos Stainless Steel and Teflon® S ...The Industry's Choice for Environmental

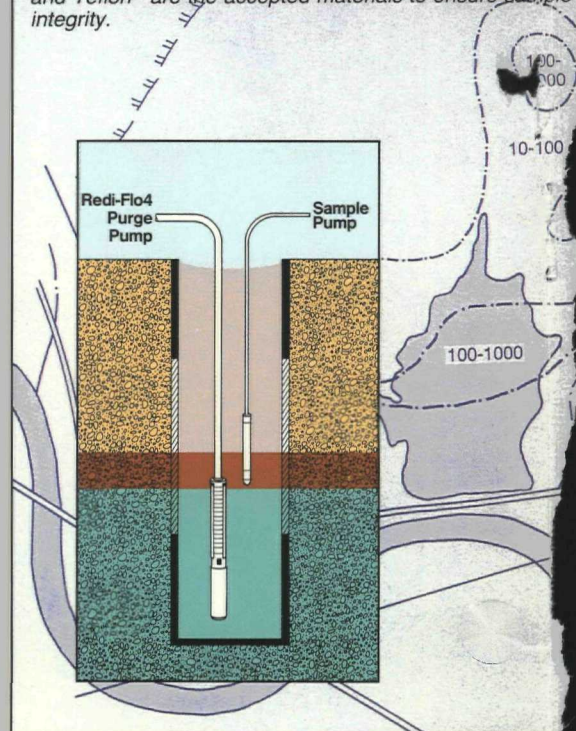


*"Environmental Engineers
Specify the Pump They've Relied
on for Years – Grundfos..."*

Environmental engineers specify Grundfos' stainless steel and Teflon® submersible as the industry's choice in well purge and water table depression applications. The importance of stainless steel and Teflon® has long been recognized and endorsed by government agencies as the accepted materials for ensuring sample integrity. With the possibility of equipment producing false readings, contamination-free equipment is an important safeguard against sample bias.

Grundfos stainless steel and Teflon® *Redi-Flo4* submersibles *meet government guidelines* for environmental equipment and have been *proven through experience in the field to be the industry choice.*

Typical monitoring well application utilizes a Grundfos **Redi-Flo4** submersible to purge the well. Stainless steel and Teflon® are the accepted materials to ensure sample integrity.



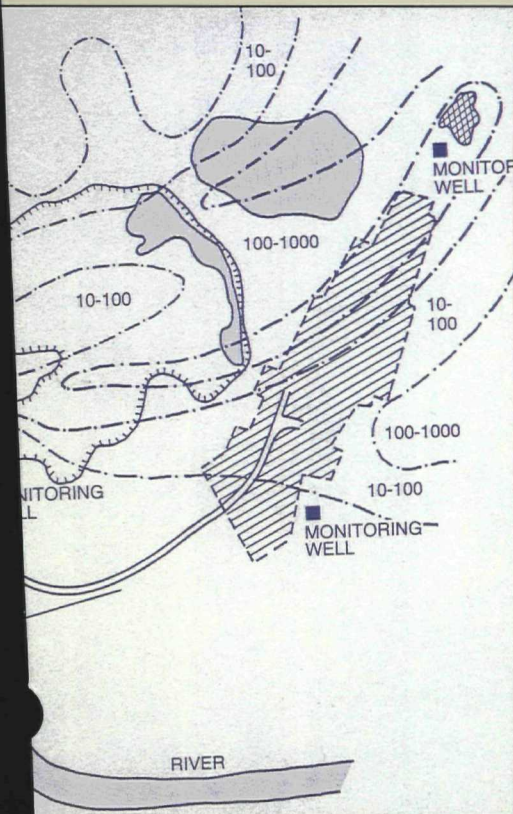
GRUNDFOS ENVIRONMENTAL PUMPS

Submersible Pumps Environmental Applications

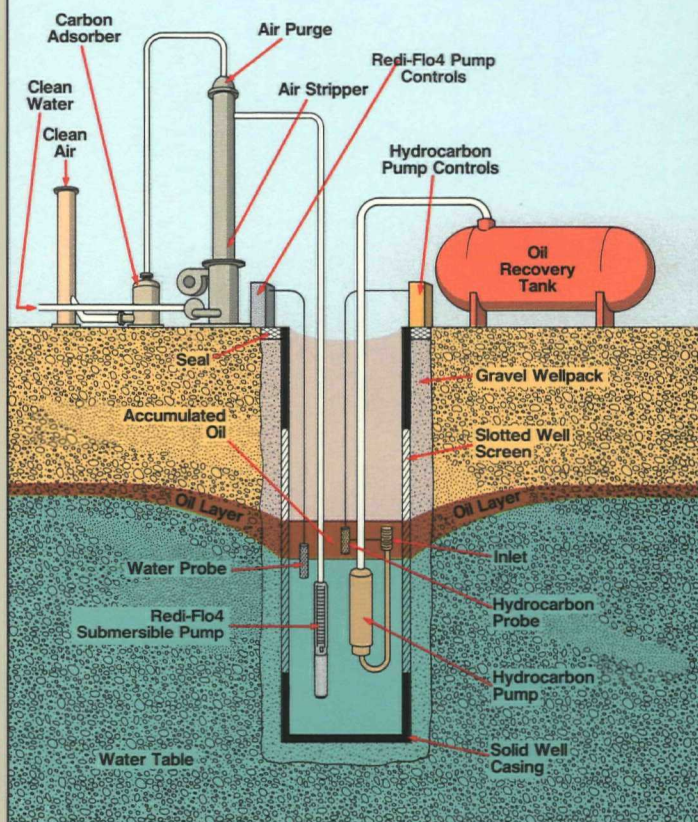
"Stainless Steel and Teflon® Minimize Sample Bias in Monitoring Wells..."

To avoid contamination by stagnant well water, monitoring wells are purged prior to sampling. Common contamination sources include interaction with well materials and equipment, degassing, atmospheric contamination, and biological activity. Purging eliminates these contaminants to ensure that samples collected are representative of the surrounding aquifer.

Sample integrity is a major concern to environmental engineers. For optimum sample integrity, Grundfos' stainless steel and Teflon® submersible pump is specified as the industry choice for purge pump applications.



Typical recovery operation utilizes a Grundfos **Redi-Flo4** submersible to create and maintain a zone of depression. Grundfos stainless steel quality ensures reliable pump operation at all specified flow rates.



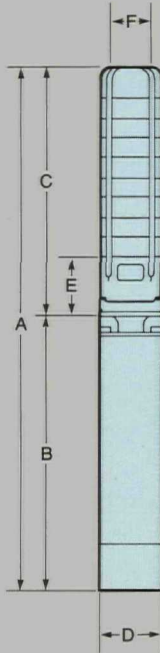
"Recovery Operations Require Specified Performance and a Broad Range of Available Product..."

Hydrogeologists and environmental engineers have developed highly successful methods for removing contaminants from groundwater. Typical clean-up operations include water table depression techniques to isolate and remove floating hydrocarbon contaminants.

With correct placement of the recovery well and proper sizing of the depression pump, the water table is depressed to stop and reverse movement of the contamination plume. Once isolated, the contaminant is removed for treatment, re-use, or proper disposal.

Redi-Flo4 pumps are designed for reliable operation in toxic environments. Rugged pump construction from the most inert materials available combined with a capacity range to 32 gpm *allows pump selection to meet exact specification requirements.* Experienced Grundfos application engineers are also on call to provide pump selection assistance for effective clean-up procedures.

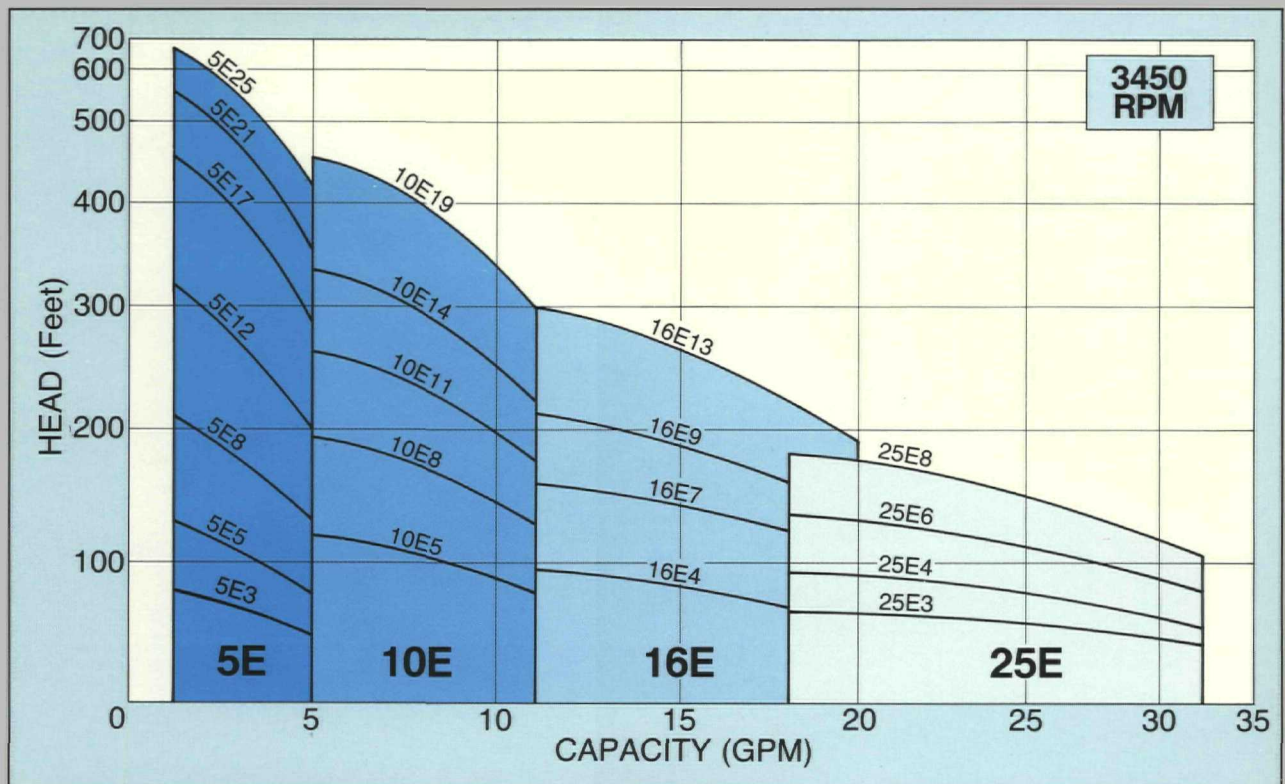
Dimensions



PUMP MODEL	MOTOR		OVERALL A	MOTOR LENGTH B	PUMP END LENGTH C	MAX. DIA. D	INLET E	DISCH. PIPE SIZE F
	HP	DIA.						
5E3	1/3	4"	18 9/16"	10"	8 9/16"	3 31/32"	3 1/4"	1" NPT
5E5	1/3	4"	20 5/16"	10"	10 5/16"	3 31/32"	3 1/4"	1" NPT
5E8	1/3	4"	22 3/4"	10"	12 3/4"	3 31/32"	3 1/4"	1" NPT
5E12	1/2	4"	26 13/16"	10 13/16"	16"	3 31/32"	3 1/4"	1" NPT
5E17	3/4	4"	31 7/16"	12 3/8"	20 3/16"	3 31/32"	3 1/4"	1" NPT
5E21	1	4"	35 7/16"	12"	23 7/16"	3 31/32"	3 1/4"	1" NPT
5E25	1 1/2	4"	40 5/16"	13 9/16"	26 3/4"	3 31/32"	3 1/4"	1" NPT
10E5	1/3	4"	20 5/16"	10"	10 5/16"	3 31/32"	3 1/4"	1 1/4" NPT
10E8	1/2	4"	23 9/16"	10 13/16"	12 3/4"	3 31/32"	3 1/4"	1 1/4" NPT
10E11	3/4	4"	26 9/16"	11 3/8"	15 3/16"	3 31/32"	3 1/4"	1 1/4" NPT
10E14	1	4"	29 11/16"	12"	17 11/16"	3 31/32"	3 1/4"	1 1/4" NPT
10E19	1 1/2	4"	35 3/8"	13 9/16"	21 13/16"	3 31/32"	3 1/4"	1 1/4" NPT
16E4	1/2	4"	20 1/4"	10 13/16"	9 7/16"	3 31/32"	3 1/4"	1 1/4" NPT
16E7	3/4	4"	23 1/4"	11 3/8"	11 7/8"	3 31/32"	3 1/4"	1 1/4" NPT
16E9	1	4"	25 9/16"	12"	13 9/16"	3 31/32"	3 1/4"	1 1/4" NPT
16E13	1 1/2	4"	30 7/16"	13 9/16"	16 7/8"	3 31/32"	3 1/4"	1 1/4" NPT
25E3	1/2	4"	19 3/8"	10 13/16"	8 9/16"	3 31/32"	3 1/4"	1 1/2" NPT
25E4	3/4	4"	20 13/16"	11 3/8"	9 7/16"	3 31/32"	3 1/4"	1 1/2" NPT
25E6	1	4"	23 1/16"	12"	11 1/16"	3 31/32"	3 1/4"	1 1/2" NPT
25E8	1 1/2	4"	26 5/16"	13 9/16"	12 3/4"	3 31/32"	3 1/4"	1 1/2" NPT

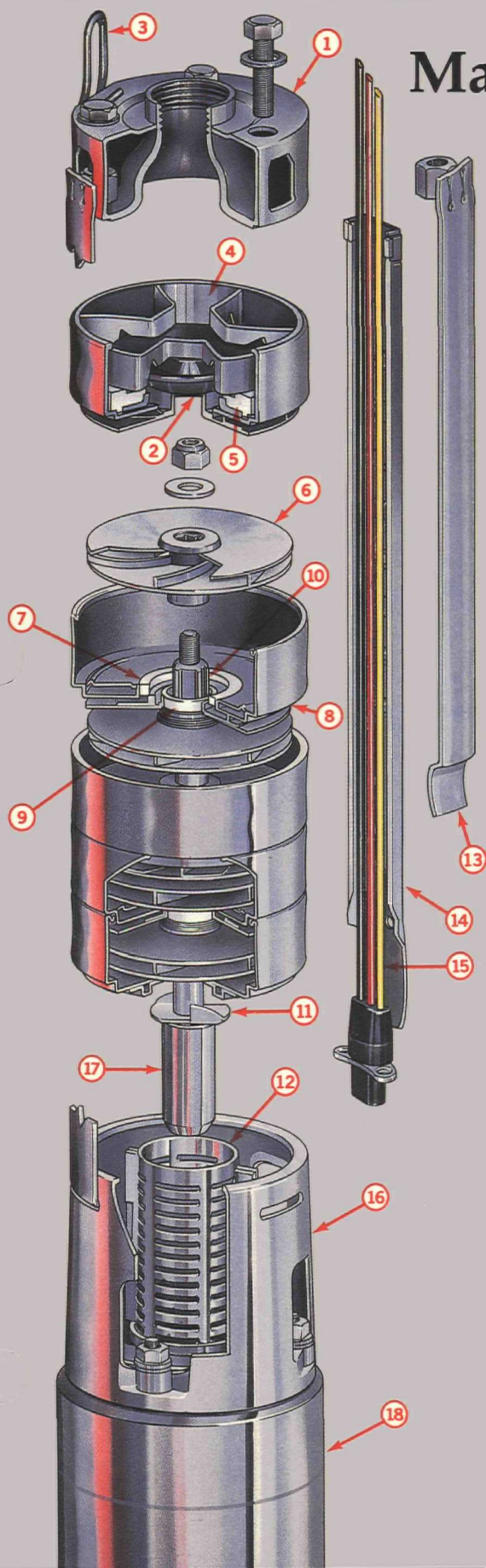
NOTE: Dimensions are for single phase motors. Specifications subject to change without notice.

Performance



GRUNDFOS ENVIRONMENTAL PUMPS

Materials and Components



1. Stainless Steel Discharge (304 SS) – light, yet durable construction is corrosion resistant with built-in stratifiers to create a smooth transition from pump to discharge connection.

2. Stainless Steel Check Valve (304 SS) – will not stick, slam, or jam. Self-cleaning.

3. Stainless Steel Safety Cable Connector (304 SS) – Non-fray loop design attaches to discharge head.

4. Stainless Steel Check Valve Retainer (304 SS) – ensures positive seating of check valve, reduces water turbulence, and eliminates vortexing at pump discharge.

5. Teflon® Check Valve Seat – provides for positive seating of check valve.

6. Stainless Steel Impeller (304 SS) – long-wearing, abrasion and corrosion resistant, with high strength-to-mass ratio. Fabricated design allows optimum hydraulic performance.

7. Teflon® Impeller Seal Ring – provides internal seals for maximum sample integrity.

8. Stainless Steel Chambers and Guide Vanes (304 SS) designed to reduce upthrust, resist corrosion, and eliminate clogging.

9. Teflon® Intermediate Bearings – placed at each stage to ensure positive shaft alignment, eliminate vibration, and maintain pump efficiency.

10. Stainless Steel Splined Shaft (304 SS) – prevents slippage of impellers on the shaft while allowing easy service and disassembly of the pump for cleaning.

11. Stainless Steel Priming Inducer (304 SS) – prevents dry running, lubricates the bearings and permits long low-flow operation.

12. Stainless Steel Slotted Inlet Screen (304 SS) – non-corrosive with slot size matched to impeller size to prevent clogging.

13. Stainless Steel Straps (304 SS) – durable and strong design allows pump end to be easily serviced.

14. Stainless Steel Motor Cable Guard (304 SS) – protects cable.

15. Teflon® Motor Cable – corrosion resistant Teflon® coated wire reduces the risk of sample bias.

16. Stainless Steel Suction Interconnector (304 SS) – rugged, NEMA design with large flow openings. Provides positive pump and motor alignment.

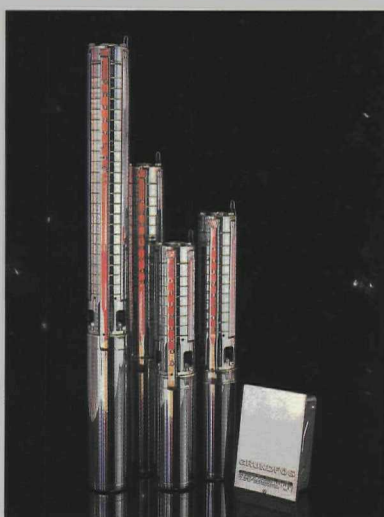
17. Stainless Steel Shaft Coupling (329/420/431 SS) – heavy-duty, corrosion resistant design.

18. Sealed Stainless Steel Motor – constructed of stainless steel, Teflon®, and Viton® and designed to meet the strict specifications required in environmental applications.



ENVIRONMENTAL PUMPS

Grundfos 4-Inch Redi-Flo4 Submersible Pumps... Stainless Steel and Teflon® Construction for Environmental Applications



Redi-Flo4 Submersibles

Grundfos *Redi-Flo4* submersibles are manufactured in Clovis, California at Grundfos' North American manufacturing facility. Distribution centers are located throughout the United States and Canada.

With stainless steel and Teflon® construction, the *Redi-Flo4* line represents the highest quality pump components manufactured from the most inert materials available. With off-the-shelf availability over a wide range of capacities and heads, the *Redi-Flo4* submersible pump has become the industry choice for environmental applications.

For more information on Grundfos *Redi-Flo4* environmental pumps, contact:

Grundfos Pumps Corp.

2555 Clovis Avenue, Clovis, CA 93612
(209) 292-8000 FAX: (209) 291-1357



National Support Center

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Grundfos Canada Inc.
5647 McAdam Road
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(416) 890-9595
FAX (416) 890-9644

Sales Training Center

Calgary, Alberta



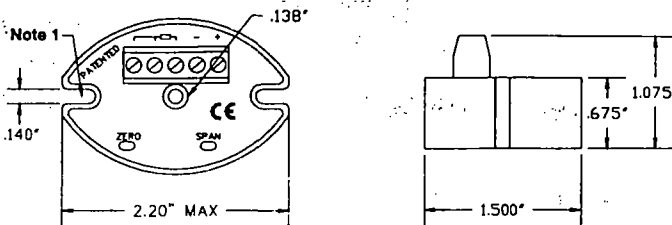
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TEMPERATURE
TRANSMITTER

General Information

The Pyromation Series 401 RTD temperature transmitter is a "two wire" loop powered resistance to current transducer. This transmitter will produce a linearized (4 to 20) mA dc output current proportional to the temperature of the RTD temperature sensor.

The transmitter's small size allows universal mounting inside Series 300, 400, and 900 screw cover heads, Series 800 explosion-proof, thermostat housings, and panel surface mounting using two 6-32 screws. The transmitter is designed for an operating ambient temperature of (-30 to 65) °C [(-22 to 149) °F].



Power Supply

The transmitter is designed for a nominal 24 V dc power supply. The transmitter will operate over a range of (9 to 36) V dc depending on the resistive load. Use the following formulas to determine the maximum resistive loading (RL) allowed for the power used, or to determine minimum supply voltage (V) required for fixed resistive loads. The formulas assume a maximum current of 20 mA.

$$V_{MIN} = 20 \text{ mA} \times R_{LOAD} + 9 \text{ V dc}$$

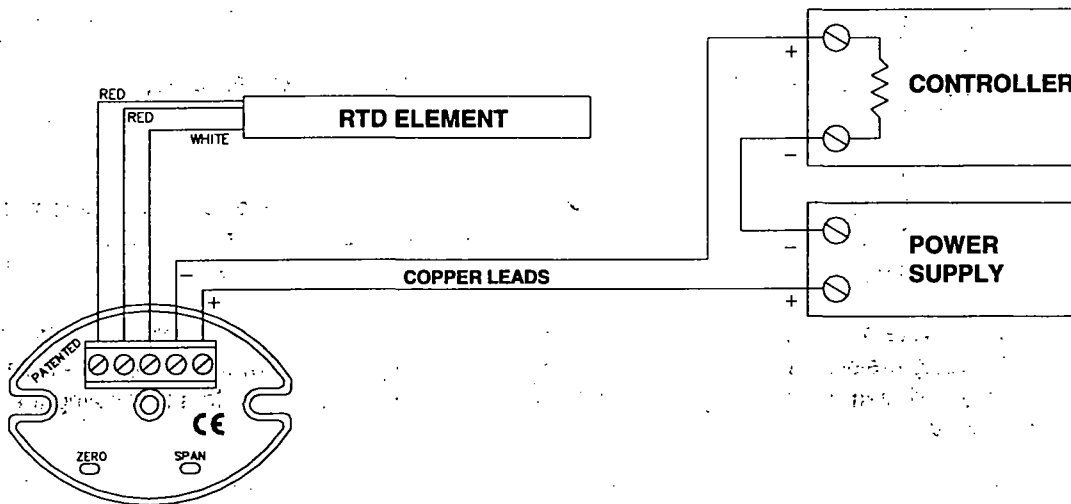
$$R_{MAXLOAD} = (V_{SUPPLY} - 9 \text{ V dc}) / 20 \text{ mA}$$

One power supply can be used for several transmitter loops. Each loop must have only one transmitter in it and all loops must be wired in parallel. Do not forget to observe the maximum current rating for your power supply.

Note: If used in a manner not specified by the manufacture, the protection provided by the equipment may be impaired.

Wiring

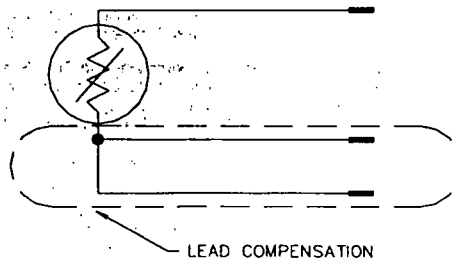
The terminal block on the transmitter can accept wire from 14 to 24 gauge. Shielded or conduit encased (twisted pair) cable is required from the transmitter to the controller, including the sensing element and lead wire. Note that low voltage lines should be run in separate conduit isolated from high voltage or high current carrying lines.



Open Sensor Indication

When an RTD has failed due to an open sensor, the transmitter will indicate an error. The way the error is produced is by either driving the current low, under 4 mA (**downscale burnout**) or by driving the current high, above 20 mA (**upscale burnout**). Upscale burnout is standard for all Pyromation transmitters.

However, the burnout indication does not apply to a break in the lead compensation loop. In this case, the burnout signal will drive the transmitter either high or low depending upon which lead has broken.



Troubleshooting

Problem

No Current Flow in Signal Loop

Current Over 20 mA

Erratic Readings

Destructive Errors

Non-Destructive Errors

Possible Causes

- Current loop may be open at some point
- No Voltage out at power supply
- Reverse polarity on loop connection
- RTD is open
- Current loop connections shorted
- Loose connection in RTD or signal loop
- Damaged RTD
- AC noise on loop connections
- Exceeds loop resistance RL
- Do not connect power to the RTD input; this could destroy the unit
- Do not connect power to the RTD sensor
- Do not use AC line power
- Reverse polarity on loop connection
- Do not connect multiple transmitter in series

Calibration

Pyromation RTD transmitters are factory calibrated. If recalibration is necessary, a **zero** and **span** adjustment can be made from the top of the unit. **Note: adjustment to calibration will void warranty**

1. Remove the RTD sensor wires and attach a RTD simulator.
2. Apply a simulated 'zero' resistance input and adjust the **zero** potentiometer for 4.00 mA output.
3. Apply a simulated 'span' resistance input and adjust the **span** potentiometer for 20.00 mA output.
4. The **zero** and **span** adjustments are interactive. Repeat steps 2 and 3 as necessary.

Application Hints

The calibrated output of the Pyromation transmitter is (4 to 20) mA. However, the lower and upper limits of output current are approximately (2.2 and 30) mA respectively. This means that for a system using a 250 ohm resistor (1 to 5) V, the maximum voltage could be as high as 7.5 volts (30 mA x 250 Ω) in the case of an open RTD.

Some computer based systems will not tolerate input voltages greater than approximately 5.5 volts. Instead of selecting a different scaling resistor (167 Ω for example gives 5 V for an open RTD), a 5.1 V zener diode in parallel with the scaling resistor will clamp the voltage across the scaling resistor to 5.1 V while still allowing the calibrated range to remain (1 to 5) V.

Limited Warranty

THE SERIES 401 RTD TEMPERATURE TRANSMITTER SOLD BY OR PURCHASED FROM PYROMATION, INC. OR FROM AN AUTHORIZED PYROMATION, INC. DISTRIBUTOR, OR AGENT IS SUBJECT TO THE FOLLOWING LIMITED WARRANTY.

This product is warranted to be free from functional defects in materials and workmanship at the time the product leaves the Pyromation, Inc. factory, and to conform at that same time to the specifications set forth in the relevant Pyromation, Inc. installation, wiring, operation manual for this product for a period of one year after shipment from the Pyromation, Inc. factory.

Pyromation's exclusive and sole obligation, and Buyer's exclusive and sole remedy under the above Limited Warranty is limited to either repair or replacement of such product, at Pyromation's option, free of charge to Buyer. Pyromation shall have no obligation to repair or replace unless the claimed defect in material or workmanship is reported in writing to Pyromation at 5211 Industrial Road, Fort Wayne, Indiana 46825 within ten (10) days after delivery to the Buyer from Pyromation or an authorized Pyromation distributor, representative or reseller. If so requested by Pyromation, the product shall be returned to a designated facility during normal business hours, transportation prepaid.

Any action for breach of this warranty or other action arising out of this contract must be commenced within one year after delivery.

Pyromation shall not be liable for any warranty, express or implied, other than the warranty stated above, and in the event of a breach of the above stated warranty, Pyromation shall not be liable for any incidental, consequential, special, or other damages, costs, or expenses other than repair or replacement as described above. Pyromation excludes any and all warranties of merchantability or fitness for a particular purpose. The above stated warranty extends only to the original Buyer from Pyromation, Inc. or from an authorized Pyromation distributor or agent, and may not be transferred or assigned.

PRESSURE
TRANSMITTER

K1, K2, K8 PRESSURE TRANSDUCER INSTRUCTION SHEET

ASHCROFT®

WARNING!

This instrument is susceptible to damage when exposed to static electrical charges. To avoid damage to the transducer observe the following:

- Ground the body of the transducer **BEFORE** making any electrical connections
- When disconnecting, remove the ground **LAST**.

Note: The braided shield and drain wire in the cable (if supplied) is not connected to the transducer body, and is not a suitable ground.

CAUTION: Pressure spikes in excess of the rated overpressure capability of the transducer may cause irreversible electrical and/or mechanical damage to the pressure measuring and containing element(s).

Mounting

The transducer requires no special mounting hardware, and can be mounted in any plane with negligible position error.

Although the unit can withstand normal vibration without damage or significant output effects, it is always good practice to mount the transducer where there is minimum vibration.

For units with NPT type pressure fittings apply teflon tape or an equivalent sealant to the threads before installing.

When tightening, apply a wrench to the hex wrench flats located just above the pressure fitting. **DO NOT** tighten by using a pipe wrench on the housing.

Power Supply – K1 Models Only

The supply voltage for the 1-5 and 1-6 Vdc output transducers must be within the range of 10 to 36 Vdc. The maximum supply voltage for a 4-20mA current output transducer is 36 Vdc while the minimum supply voltage is dependent upon the loop resistance of the circuit. The load limitation chart shows the minimum supply voltage (V_{min}) required for a given loop resistance (R_{LOOP}).

Noise

For minimum noise susceptibility, avoid running the transducer's cable in a conduit that contains high current AC power cables. Where possible avoid running the cable near inductive equipment.

Shield Wiring

Connect the braided shield to the guard terminal on the reading instrument (meter, etc.) if available or to ground or to the power supply negative terminal.

Adjustment Potentiometers

The zero and span pots are accessible through the top of the case. Loosen the four screws and separate the top carefully. The zero pot is marked with a white dot.

Vent Tube

The cable will have a clear Teflon vent tube that's required at pressure below 500 psi to provide atmospheric reference. The open end should be placed in a dry area.

Output – K8 Only

Sensitivity may be from 6 mV/V to 18 mV/V for any individual transducer. Zero offset is within ± 3 mV/V. Output is proportional to supply voltage (ratiometric).

Excitation – K8 & K2

For proper operation a voltage within the range of 5 to 10 Vdc must be applied between the transducer's supply terminals.

Life Support Policy

Dresser's products are not authorized for use as critical components in life support devices or systems without the express written approval of the General Manager, Transducer Operation of Dresser Industries Instrument Division. As used herein:

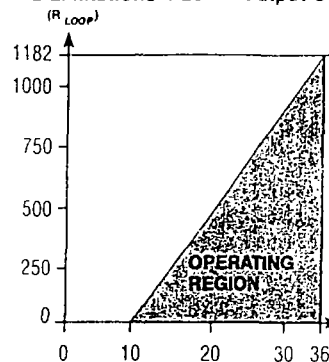
1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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DRESSER INSTRUMENT

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Load Limitations 4-20mA Output Only



$$V_{min} = 10V + (.022A \times R_L)$$

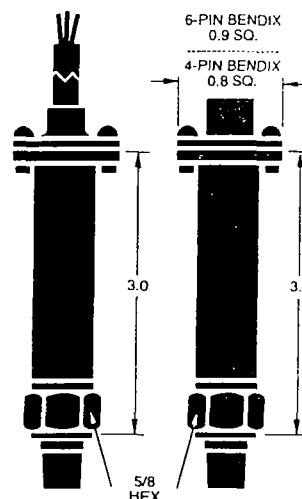
$$R_L = R_S + R_W$$

R_L = Loop Resistance (ohms)

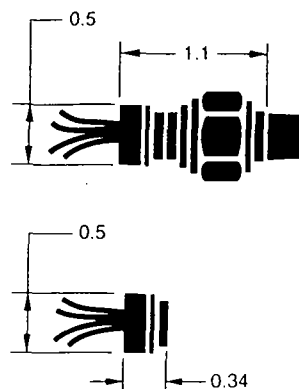
R_S = Sense Resistance (ohms)

R_W = Wire Resistance (ohms)

K1, K2 Transducers

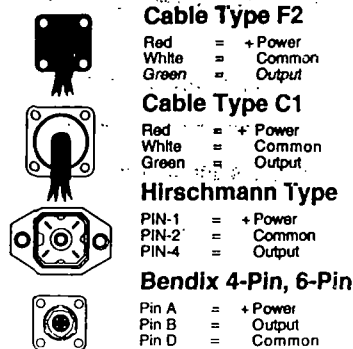


K8 Transducers

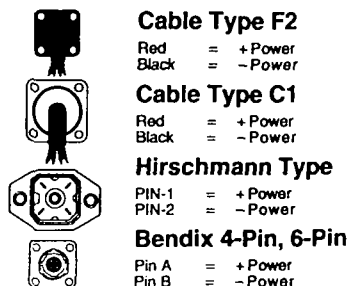


K1 Transducers – Electrical Connections

Voltage Output Units 1-5, 1-6 Vdc

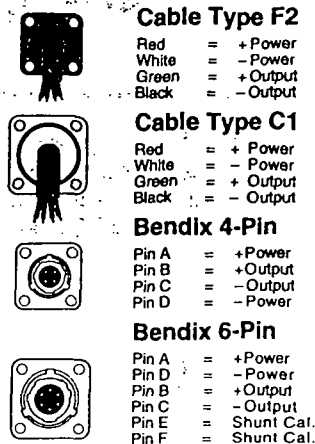


Current Output Units 4-20mA



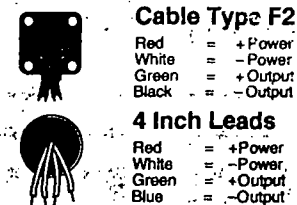
K2 Transducers – Electrical Connections

Ratiometric (mV/V)



K8 Transducers – Electrical Connections

Ratiometric (mV/V)



Special Wiring – See "X" Variation On Unit Label

Variation	Wire Hookup
XTQ	Red = + Power Black = Common White = Output
XTG	Red = + Power Black = Common Green = Output

WARNING: READ BEFORE INSTALLATION

Fluid hammer and surges can destroy any pressure transducer and must always be avoided. A pressure snubber should be installed to eliminate the damaging hammer effects. Fluid hammer occurs when a liquid flow is suddenly stopped, as with quick closing solenoid valves. Surges occur when flow is suddenly begun, as when a pump is turned on at full power or a valve is quickly opened.

Liquid surges are particularly damaging to pressure transducers if the pipe is originally empty. To avoid damaging surges, fluid lines should remain full (if possible), pumps should be brought up to power slowly, and valves opened slowly. To avoid damage from both fluid hammer and surges, a surge chamber should be installed.

Symptoms of fluid hammer and surge's damaging effects:

- Pressure transducer exhibits an output at zero pressure (large zero offset). If zero offset is less than 10% FS, user can usually re-zero transducer, install proper snubber and continue monitoring pressures.
- Pressure transducer output remains constant regardless of pressure.
- In severe cases, there will be no output.

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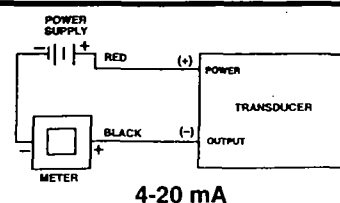
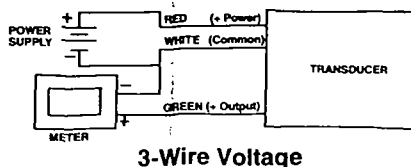
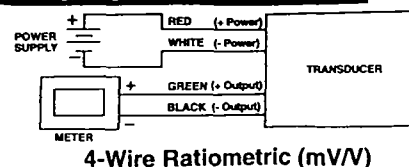
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DRESSER INDUSTRIES, INC.
 INSTRUMENT DIVISION
 38 WELLINGTON ROAD
 MILFORD, CONNECTICUT 06460 U.S.A.
 (203) 783-6650 VOICE
 (203) 783-6659 FAX

Recalibration Instructions:

- Apply 0% Full Scale Pressure.
- Set the output using the *Zero adjustment potentiometer*.
- Apply 100% Full Scale Pressure.
- Set the output using the *Span adjustment potentiometer*.
- Repeat steps 1 thru 4 as necessary.

Wiring Diagrams for All Transducers



DATE	REV	ECO	REVISION	BY	CHK	EOR
2/4/02	A	3463	ADDED SERIES 35, 335 & 735, ADDED VOLTAGE SUPPRESSION OPTIONS.	CHF		SMK
2/6/02	B	N/A	ADDED T SUFFIX TO SERIES # FOR TITANIUM OPTION.	CHF		SMK
3/5/02	C	3498	ADDED MV OUTPUT DIAGRAM.	CHF		SMK
3/19/02	D	3498	REVISE EXCITATION OUTPUT 7.	CHF		SMK

**Class I, II, III, Div. 1
Groups A-G
Hazardous Location**

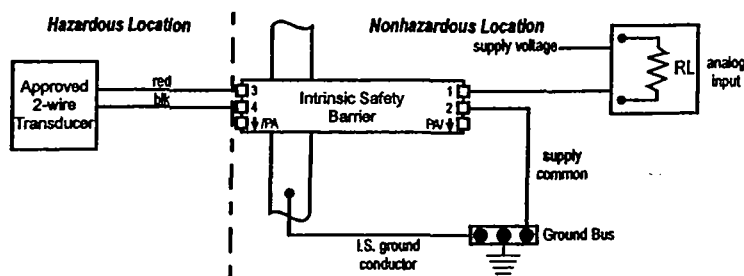


Figure 1. Wiring diagram for 2-wire, 4-20mA output.
(see notes 1 and 3)

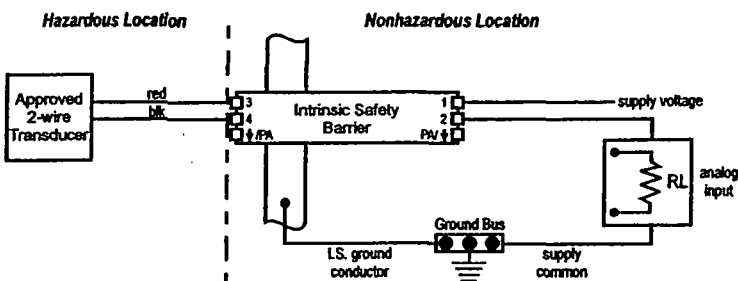


Figure 2. Wiring diagram for 2-wire, 4-20mA output.
(see notes 1 and 3)

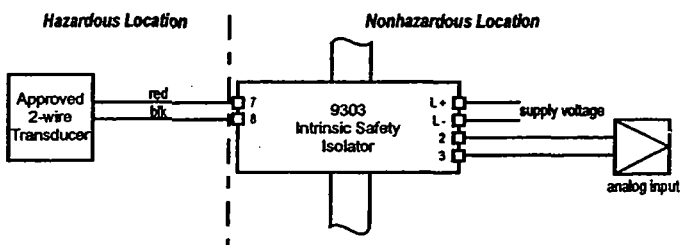


Figure 3. Wiring diagram for 2-wire, 4-20mA output.
(see notes 1 and 3)

The Transducers listed below are designed for installation in a Class I, Division 1, Groups A, B, C and D, Class II, Division 1, Groups E, F, and G, Class III, Division 1 hazardous location when connected to Associated Apparatus as described below.

When installing a transducer with the temperature output option (XXX-A7C-D0EEEE), additionally install a duplicate barrier (as referenced below in note 3) for the 4-20 mA temperature loop.

Series 27-ABC-D0EEEE, 28-ABC-D0EEEE,
30-ABC-D0EEEE, 35-ABC-D0EEEE
A = pressure type: 1,3,4
B = excitation/output: 1,2,3,4,5,7
C = pressure connection: 1,2,4,5,6,7,8
D = electrical connection: 1,4
EEEE = pressure range: 0-2000 PSI

Voltage Suppression options available with these series:
Option-009, Option-012

Series 700-ABC-D0EEEE, 710-ABC-D0EEEE,
720-ABC-D0EEEE, 730-ABC-D0EEEE,
735-ABC-D0EEEE, 750-ABC-D0EEEE
A = pressure type: 1,3,4
B = excitation/output: 1,2,3,4,5,7
C = pressure connection: 2,0,A,B,C,D
D = electrical connection: 0,4
EEEE = pressure range: 0-300 PSI

Voltage Suppression options available with these series:
Option-009, Option-012
T after series # indicates Titanium housing and
Hastelloy or Titanium sensor. (Except 750)

Series 300-ABC-D0EEEE, 320-ABC-D0EEEE,
330-ABC-D0EEEE, 335-ABC-D0EEEE
A = pressure type: 1,3
B = excitation/output: 3,4
C = pressure connection: 0
D = electrical connection: 0
EEEE = pressure range: 0-300 PSI

Voltage Suppression options available with these series:
Option-009, Option-012
T after series # indicates Titanium housing and
Hastelloy or Titanium sensor.

WARNING:

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REVISIONS MUST BE SUBMITTED FOR AGENCY APPROVAL.

DRAWN	CHECKED	ENGINEER	APPROVED
CHF	J. 2. H.	Spill	
4/24/00	3/14/02	3/20/02	
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES			
INCHES	MILLIMETERS	ANGLE +/-3	
.XX 0.03	.X 0.8	BREAK SHARP EDGES APPROX .006/.010	
.XXX 0.005	.XX 0.13		
ALL DIMENSIONS APPLICABLE AFTER SURFACE TREATMENT		SURFACE FINISH 63	
HEAT TREATMENT		CODE IDENT NO	
MATERIAL SPEC		DWG SCALE NTS	



PRESSURE SYSTEMS
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CSA

DRAWING LAST UPDATED
DATE: 03/19/02
TIME: 12:02:00
BY: CHF

DRAWING NO
TA-6611
PSI STOCK NO
DO NOT SCALE DRAWING
REVISION
D
SHEET 1/3

DATE	REV	ECO	REVISION	BY	CHK	EOR
2/4/02	A	3463	ADDED SERIES 35, 335 & 735. ADDED VOLTAGE SUPPRESSION OPTIONS.	CHF		SMK
2/6/02	B	N/A	ADDED T SUFFIX TO SERIES # FOR TITANIUM OPTION.	CHF		SMK
3/5/02	C	3498	ADDED MV OUTPUT DIAGRAM.	CHF		SMK
3/19/02	D	3498	REVISE EXCITATION OUTPUT 7.	CHF		SMK

**Class I, II, III, Div. 1
Groups A-G
Hazardous Location**

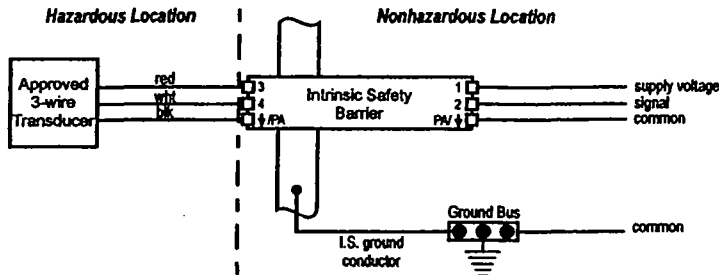
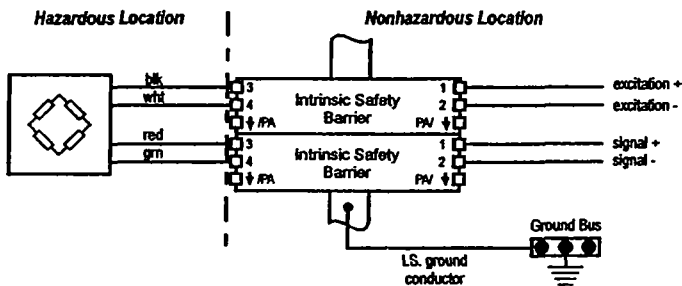


Figure 4. Wiring diagram for 3-wire, 0-5V output.
(see notes 2, 3, 4 and 5)



Wiring diagram for 4-wire, mV output. (see notes 5, 6 and 7)

Notes:

1A. For System Certification, Associated Apparatus shall be CSA certified with the following parameters: **B = 4**

Channel	V _{max} / R _{min}	Lead
I	28V / 267 Ω	red to black
II	10V / 50 Ω or 28V / diode	black to ground

1B. For System Certification, Associated Apparatus shall be CSA certified with the following parameters: **B = 7**

Channel	V _{max} / R _{min}	Lead
I	28V / 560 Ω	red to black
II	10V / 50 Ω or 28V / diode	black to ground

2. For System Certification, Associated Apparatus shall be CSA certified with the following parameters: **B = 3**

Channel	V _{max} / R _{min}	Lead
I	28V / 300 Ω	red to black
II	10V / 50 Ω	white to black

3. Recommended Associated Apparatus as follows:

Mfg.	Part Number	Figure Number
R. Stahl	9001/01-280-100-10	1
R. Stahl	9001/51-280-110-14	2
R. Stahl	9002/13-280-110-00	2
R. Stahl	9303/11-22-11	3
R. Stahl	9002/11-280-293-00	4
R. Stahl	9001/01-280-50-10	2

B = 4
B = 3
B = 7

4. Where more than one barrier/channel is used, barriers/channels must be of the same polarity.

5. For System Certification, Associated Apparatus shall be CSA certified with the following parameters: **B = 1**

Channel	V _{max} / R _{min}	Lead
I	9.3V / 39 Ω	blk to gnd
II	9.3V / 39 Ω	wht to gnd
III	9.6V / 475 Ω	red to gnd
IV	9.6V / 475 Ω	grn to gnd

6. For System Certification, Associated Apparatus shall be CSA certified with the following parameters: **B = 2,5**

Channel	V _{max} / R _{min}	Lead
I	28V / 300 Ω	blk to gnd
II	10V / 50 Ω	wht to gnd
III	9.6V / 475 Ω	red to gnd
IV	9.6V / 475 Ω	grn to gnd

7. Recommended Associated Apparatus as follows:

Mfg.	Part Number	LEADS
R. Stahl	9002/10-187-270-00	excitation B = 1
R. Stahl	9002/22-093-040-00	signal
R. Stahl	9002/11-280-293-00	excitation B = 2,5

8. Control Room apparatus shall not generate in excess of 250V (U_{max}).

9. Installation should be in accordance with Appendix F of the Canadian Electrical Code, Part I.

WARNING:

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DRAWN	CHECKED	ENGINEER	APPROVED
CHF	<i>[Signature]</i>	<i>[Signature]</i>	
4/24/00	3/14/02	3/14/02	
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES			
INCHES	MILLIMETERS	ANGLE +/-3	
.XX 0.03	.X 0.8	BREAK SHARP EDGES	
.XXX 0.005	.XX 0.13	APPROX .005/.010	
ALL DIMENSIONS APPLICABLE AFTER SURFACE TREATMENT		SURFACE FINISH	
HEAT TREATMENT		63	
MATERIAL SPEC		CODE IDENT NO	
		DWG SCALE	
		NTS	



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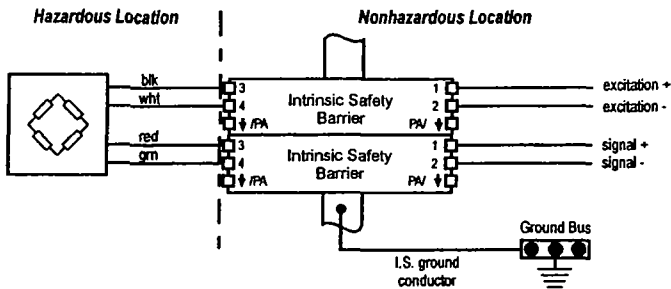
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CERTIFICATION DRAWING
CSA

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PSI STOCK NO	DO NOT SCALE DRAWING
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DRAWING LAST UPDATED
DATE: 03/19/02
TIME: 12:02:00
BY: CHF

DATE	REV	ECO	REVISION	BY	CHK	EOR
2/4/02	A	3463	ADDED SERIES 35, 335 & 735, ADDED VOLTAGE SUPPRESSION OPTIONS.	CHF		SMK
2/6/02	B	N/A	ADDED T SUFFIX TO SERIES # FOR TITANIUM OPTION.	CHF		SMK
3/5/02	C	3498	ADDED MV OUTPUT DIAGRAM.	CHF		SMK
3/19/02	D	3498	REVISE EXCITATION OUTPUT 7.	CHF		SMK

**Class I, II, III, Div. 1
Groups A-G
Hazardous Location**



Wiring diagram for 4-wire, mV output. (see notes 1 and 2)

The Series 169 and 173 Depth Transducers are designed for installation in a Class I, Division 1, Groups A, B, C and D, Class II, Division 1, Groups E, F, and G, Class III, Division 1 hazardous location when connected to Associated Apparatus as described in note 1.

Series 169-ABC-D0EEEE, 173-ABC-D0EEEE

A = pressure type: 1,3
B = excitation/output: 1
C = pressure connection: 2,0,B,C
D = electrical connection: 0,4
EEEE = pressure range: 0-300 PSI

T after series # indicates Titanium housing and Hastelloy or Titanium sensor.

Notes:

1. For System Certification, Associated Apparatus shall be CSA certified with the following parameters:

Channel	Vmax / Rmin	Lead
I	9.3V / 39 Ω	blk to gnd
II	9.3V / 39 Ω	wht to gnd
III	9.6V / 475 Ω	red to gnd
IV	9.6V / 475 Ω	grn to gnd

2. Recommended Associated Apparatus as follows:

Mfg.	Part Number	Leads
R. Stahl	9002/10-187-270-00	excitation
R. Stahl	9002/22-093-040-00	signal

3. Control Room apparatus shall not generate in excess of 250V (U_{max}).

4. Installation should be in accordance with Appendix F of the Canadian Electrical Code, Part I.

General Notes:

1. This drawing applies to KPSI Series 27, 28, 30, 35, 169, 173, 300, 320, 330, 335, 700, 710, 720, 730, 735, 750 transducers.

WARNING:

THIS PART IS USED IN AN AGENCY APPROVED ASSEMBLY.
REVISIONS MUST BE SUBMITTED FOR AGENCY APPROVAL.

DRAWN	CHECKED	ENGINEER	APPROVED
CHF	J. B. H. G. H.		
4/24/00	3/29/23/20/02		
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES			
INCHES	MILLIMETERS	ANGLE +/-3	
.XX 0.03	.X 0.8	BREAK SHARP EDGES	
.XXX 0.005	.XX 0.13	APPROX .005/.010	
ALL DIMENSIONS APPLICABLE AFTER SURFACE TREATMENT		SURFACE FINISH	
HEAT TREATMENT		63	
MATERIAL SPEC		CODE IDENT NO	
		DWG SCALE	
		NTS	



PRESSURE SYSTEMS
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CSA

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TA-6611	D
PSI STOCK NO	DO NOT SCALE DRAWING
	SHEET 3/3

DRAWING LAST UPDATED
DATE: 03/19/02
TIME: 12:02:00
BY: CHF

DATE	REV	ECO	REVISION	BY	CHK	EOR
12/3/01	A	3463	ADDED SERIES 35, 335 & 735. ADDED P_{max} TO ENTITY PARAMETERS FOR 4-20mA SENSORS.	CHF		SMK
2/4/02	B	3463	ADDED VOLTAGE SUPPRESSION OPTIONS.	CHF		SMK
2/5/02	C	N/A	ADDED T SUFFIX TO SERIES # FOR TITANIUM OPTION.	CHF		SMK
3/1/02	D	3498	ADDED MV OUTPUT DIAGRAM.	CHF		SMK
3/19/02	E	3498	REVISE EXCITATION UOTPUT 7.	CHF		SMK

**Class I, II, III, Div. 1
Groups A-G
Hazardous Location**

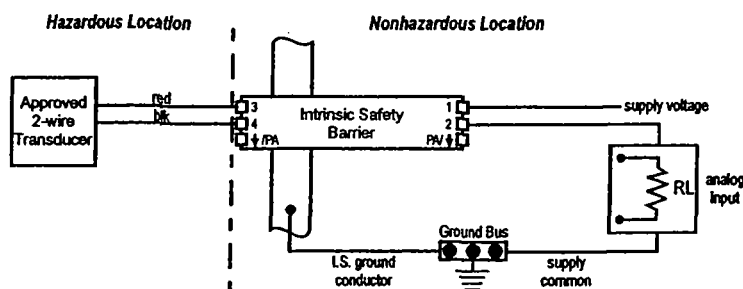


Figure 1. Return Lead Floating

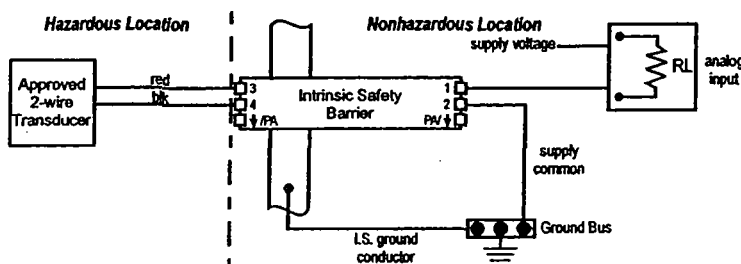


Figure 2. Return Lead Grounded

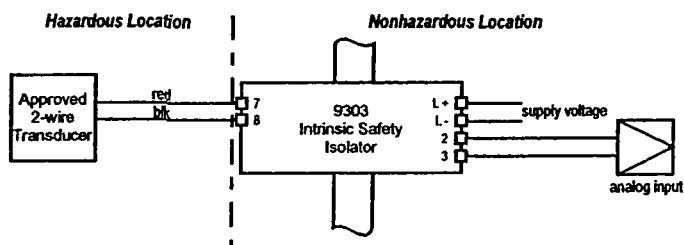


Figure 3. Field Circuit Isolated

Wiring diagram for 2-wire, 4-20mA output.
(see note 2 and all sectional notes)

The Transducers listed below are designed for installation in a Class I, Division 1, Groups A, B, C and D, Class II, Division 1, Groups E, F, and G, Class III, Division 1 hazardous location when connected to Associated Apparatus as described in note 1.

When installing a transducer with the temperature output option (XXX-A7C-D0EEEE), additionally install a duplicate barrier (as referenced below in note 2) for the 4-20 mA temperature loop.

Series 27-ABC-D0EEEE, 28-ABC-D0EEEE,
30-ABC-D0EEEE, 35-ABC-D0EEEE
A = pressure type: 1,3,4
B = excitation/output: 1,2,3,4,5,7
C = pressure connection: 1,2,4,5,6,7,8
D = electrical connection: 1,2,3,4
EEEE = pressure range: 0-2000 PSI

Voltage Suppression options available with these series:
Option-009, Option-012

Series 700-ABC-D0EEEE, 710-ABC-D0EEEE,
720-ABC-D0EEEE, 730-ABC-D0EEEE,
735-ABC-D0EEEE, 750-ABC-D0EEEE
A = pressure type: 1,3,4
B = excitation/output: 1,2,3,4,5,7
C = pressure connection: 2,0,A,B,C,D
D = electrical connection: 0,4
EEEE = pressure range: 0-300 PSI

Voltage Suppression options available with these series:
Option-009, Option-012
T after series # indicates Titanium housing and Hastelloy or Titanium sensor. (Except 750)

Series 300-ABC-D0EEEE, 320-ABC-D0EEEE,
330-ABC-D0EEEE, 335-ABC-D0EEEE
A = pressure type: 1,3
B = excitation/output: 3,4
C = pressure connection: 0
D = electrical connection: 0
EEEE = pressure range: 0-300 PSI

Voltage Suppression options available with these series:
Option-009, Option-012
T after series # indicates Titanium housing and Hastelloy or Titanium sensor.

Entity Parameters (B = 2,3,4,5)

$V_{max} = 28V$
 $I_{max} = 110mA$
 $C_i = 0.064\mu F$
 $L_i = 0$
 $P_{max} = 1W$

Entity Parameters (B = 7)

$V_{max} = 28V$
 $I_{max} = 50mA$
 $C_i = 0.064\mu F$
 $L_i = 0$
 $P_{max} = 1W$

Entity Parameters (B=1)

$V_{max} = 18.7V$
 $I_{max} = 293mA$
 $C_i = 0$
 $L_i = 0$

WARNING:

THIS PART IS USED IN AN AGENCY APPROVED ASSEMBLY.
REVISIONS MUST BE SUBMITTED FOR AGENCY APPROVAL.

DRAWN	CHECKED	ENGINEER	APPROVED
CHF	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
4/24/00	3/28/03	3/20/02	
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES			
INCHES	MILLIMETERS	ANGLE +/-3	
.XX 0.03	.X 0.8	BREAK SHARP EDGES APPROX .005/.010	
.XXX 0.005	.XX 0.13		
ALL DIMENSIONS APPLICABLE AFTER SURFACE TREATMENT		SURFACE FINISH 63	
HEAT TREATMENT		CODE IDENT NO	
MATERIAL SPEC		DWG SCALE NTS	



PRESSURE SYSTEMS
34 RESEARCH DRIVE * HAMPTON, VA 23666

DRAWING TITLE
CERTIFICATION DRAWING
FM

DRAWING LAST UPDATED
DATE: 03/19/02
TIME: 14:12:00
BY: CHF

DRAWING NO
TA-6609
REVISION
E

PSI STOCK NO
DO NOT SCALE DRAWING
SHEET 1/3

DATE	REV	ECO	REVISION	BY	CHK	EOR
12/3/01	A	3463	ADDED SERIES 35, 335 & 735, ADDED P _{max} TO ENTITY PARAMETERS FOR 4-20mA SENSORS.	CHF		SMK
2/4/02	B	3463	ADDED VOLTAGE SUPPRESSION OPTIONS.	CHF		SMK
2/5/02	C	N/A	ADDED T SUFFIX TO SERIES # FOR TITANIUM OPTION.	CHF		SMK
3/1/02	D	3498	ADDED MV OUTPUT DIAGRAM.	CHF		SMK
3/19/02	E	3498	REVISE EXCITATION UOTPUT 7.	CHF		SMK

**Class I, II, III, Div. 1
Groups A-G
Hazardous Location**

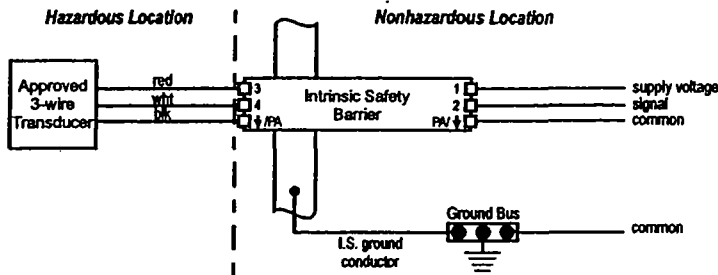


Figure 4. Wiring diagram for 3-wire, 0-5V output.
(see note 2 and all sectional notes)

Notes:

1. Associated Apparatus shall provide intrinsically safe connections which meet the following parameters.

$$\begin{aligned} V_T &\leq V_{\max} & C_s &\geq C_T + C_{\text{leads}} \\ I_T &\leq I_{\max} & L_s &\geq L_T + L_{\text{leads}} \\ P_T &< P_{\max} \end{aligned}$$

2. Recommended Associated Apparatus as follows:

Mfg.	Model No.	Figure
R. Stahl	9001/01-280-100-10	2
R. Stahl	9001/51-280-110-14	1
R. Stahl	9002/13-280-110-00	1
R. Stahl	9303/11-22-11	3
R. Stahl	9002/11-280-293-00	4
R. Stahl	9001/01-280-50-10	2

B = 4
B = 3
B = 7

3. Recommended Associated Apparatus as follows:

Mfg.	Model No.	Leads
R. Stahl	9002/22-093-040-00	Signal
R. Stahl	9002/10-187-270-00	Excitation B = 1
R. Stahl	9002/11-280-293-00	Excitation B = 2 or 5

4. Control Room apparatus shall not generate in excess of 250V (U_{max}).

5. Installation should be in accordance with Article 504 in the National Electrical Code, ANSI/NFPA 70

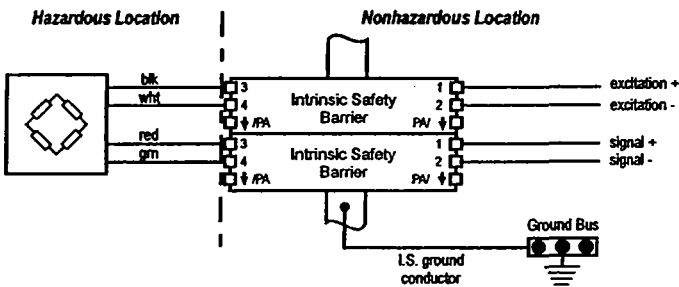


Figure 5. Wiring diagram for 4-wire, mV output.
(see note 3 and all sectional notes)

WARNING:

THIS PART IS USED IN AN AGENCY APPROVED ASSEMBLY.
REVISIONS MUST BE SUBMITTED FOR AGENCY APPROVAL.

DRAWN	CHECKED	ENGINEER	APPROVED
CHF	<i>[Signature]</i>	<i>[Signature]</i>	
4/24/00	3/2/02	3/20/02	
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES			
INCHES	MILLIMETERS	ANGLE +/- 3	
.XX 0.03	.X 0.8	BREAK SHARP EDGES	
.XXX 0.005	.XX 0.13	APPROX .005/.010	
ALL DIMENSIONS APPLICABLE AFTER SURFACE TREATMENT		SURFACE FINISH	
HEAT TREATMENT		63	
MATERIAL SPEC		CODE IDENT NO	
		DWG SCALE	
		NTS	



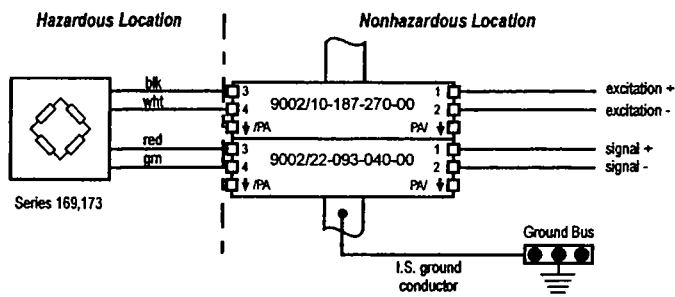
PRESSURE SYSTEMS
34 RESEARCH DRIVE • HAMPTON, VA. 23666

DRAWING TITLE
CERTIFICATION DRAWING
FM

DRAWING LAST UPDATED
DATE: 03/19/02
TIME: 14:12:00
BY: CHF

DRAWING NO	REVISION
TA-6609	E
PSI STOCK NO	DO NOT SCALE DRAWING
	SHEET 2/3

DATE	REV	ECO	REVISION	BY	CHK	EOR
12/3/01	A	3463	ADDED SERIES 35, 335 & 735. ADDED P_{max} TO ENTITY PARAMETERS FOR 4-20mA SENSORS.	CHF		SMK
2/4/02	B	3463	ADDED VOLTAGE SUPPRESSION OPTIONS.	CHF		SMK
2/5/02	C	N/A	ADDED T SUFFIX TO SERIES # FOR TITANIUM OPTION.	CHF		SMK
3/1/02	D	3498	ADDED MV OUTPUT DIAGRAM.	CHF		SMK
3/19/02	E	3498	REVISE EXCITATION UOTPUT 7.	CHF		SMK



Wiring diagram for 4-wire, mV output.
(see note 2 and all sectional notes)

The Series 169 and 173 Depth Transducers are designed for installation in a Class I, Division 1, Groups A, B, C and D, Class II, Division 1, Groups E, F, and G, Class III, Division 1 hazardous location when connected to Associated Apparatus as described in note 1.

Series 169-ABC-D0EEEE, 173-ABC-D0EEEE

A = pressure type: 1,3

B = excitation/output: 1

C = pressure connection: 2,0,B,C

D = electrical connection: 0,4

EEEE = pressure range: 0-300PSI

T after series # indicates Titanium housing and Hastelloy or Titanium sensor.

Entity Parameters

$$V_{max} = 18.7V$$

$$I_{max} = 293mA$$

$$C_1 = 0$$

$$L_1 = 0$$

Notes:

1. Associated Apparatus shall provide intrinsically safe connections which meet the following parameters.

$$V_T \leq V_{max} \quad C_a \geq C_1 + C_{leads}$$

$$I_T \leq I_{max} \quad L_a \geq L_1 + L_{leads}$$

2. Recommended Associated Apparatus as follows:

Mfg.	Model No.
R. Stahl	9002/10-187-270-00
R. Stahl	9002/22-093-040-00

3. Control Room apparatus shall not generate in excess of 250V (U_{max}).

4. Installation should be in accordance with Article 504 in the National Electric Code, ANSI/NFPA 70.

WARNING:

THIS PART IS USED IN AN AGENCY APPROVED ASSEMBLY.
REVISIONS MUST BE SUBMITTED FOR AGENCY APPROVAL

DRAWING LAST UPDATED
DATE: 03/19/02
TIME: 14:12:00
BY: CHF

DRAWN	CHECKED	ENGINEER	APPROVED
CHF	<i>[Signature]</i>	<i>[Signature]</i>	
4/24/00	3/26/02	3/20/04	
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES			
INCHES	MILLIMETERS	ANGLE +/-3	
.XX 0.03	.X 0.8	BREAK SHARP EDGES	
.XXX 0.005	.XX 0.13	APPROX .005/.010	
ALL DIMENSIONS APPLICABLE AFTER SURFACE TREATMENT		SURFACE FINISH 63	
HEAT TREATMENT		CODE IDENT NO	
MATERIAL SPEC		DWG SCALE NTS	



PRESSURE SYSTEMS
34 RESEARCH DRIVE * HAMPTON, VA. 23666

DRAWING TITLE
CERTIFICATION DRAWING
FM

DRAWING NO	REVISION
TA-6609	E
PSI STOCK NO	DO NOT SCALE DRAWING
	SHEET 3/3

DATE	REV	ECO	REVISION	BY	CHK	EOR
12/20/01	A	3463	ADDED SERIES 35, 335 & 735; ADDED VOLTAGE SUPPRESSION OPTIONS.	CHF		SMK
2/6/02	B	N/A	ADDED T SUFFIX TO SERIES # FOR TITANIUM OPTION.	CHF		SMK
3/4/02	C	3498	ADDED MV OUTOUT DIAGRAM.	CHF		SMK
3/19/02	D	3498	REVISE EXCITATION OUTPUT 7.	CHF		SMK
6/13/02	E	3496	ADD SERIES 500 & 510 INFORMATION.	CHF		SMK
6/19/02	F	3496	REVISE SERIES 500 & 510 INFORMATION.	CHF		SMK
7/2/02	G	N/A	TITANIUM OPTION WAS NOT SHOWN FOR SERIES 500,510.	CHF		SMK
8/1/02	H	N/A	REVISED NOTES 7,8 & 9 FOR SERIES 500,510.	CHF		SMK

**Class I, II, III, Div. 1
Groups A-G
Hazardous Location**

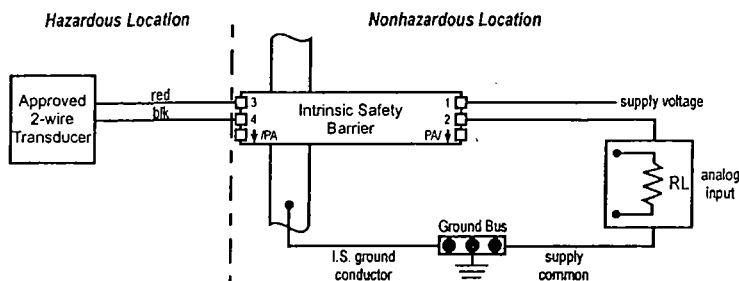


Figure 1. Return Lead Floating

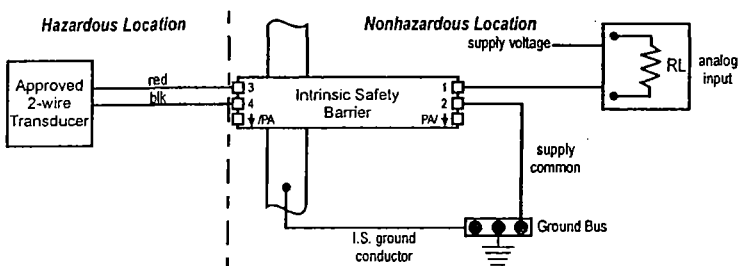


Figure 2. Return Lead Grounded

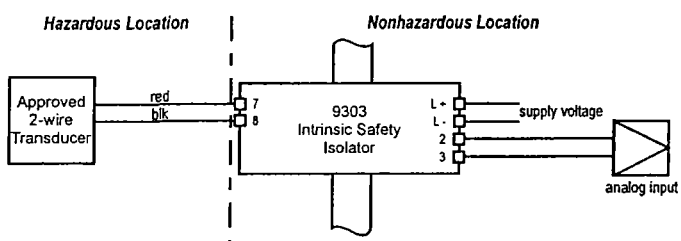


Figure 3. Field Circuit Isolated

Wiring diagram for 2-wire, 4-20mA output.
(see note 2 and all sectional notes)

The Transducers listed below are designed for installation in a Class I, Division 1, Groups A, B, C and D, Class II, Division 1, Groups E, F, and G, Class III, Division 1 hazardous location when connected to Associated Apparatus as described in note 1.

When installing a transducer with the temperature output option (XXX-A7C-D0EEEE), additionally install a duplicate barrier (as referenced below in note 2) for the 4-20 mA temperature loop.

Series 27-ABC-D0EEEE, 28-ABC-D0EEEE,
30-ABC-D0EEEE, 35-ABC-D0EEEE
A = pressure type: 1,3,4
B = excitation/output: 1,2,3,4,5,7
C = pressure connection: 1,2,4,5,6,7,8
D = electrical connection: 1,2,3,4
EEEE = pressure range: 0-2000 PSI

Voltage Suppression options available with these series:
Option-009, Option-012

Series 700-ABC-D0EEEE, 710-ABC-D0EEEE,
720-ABC-D0EEEE, 730-ABC-D0EEEE,
735-ABC-D0EEEE, 750-ABC-D0EEEE
A = pressure type: 1,3,4
B = excitation/output: 1,2,3,4,5,7
C = pressure connection: 2,0,A,B,C,D
D = electrical connection: 0,4
EEEE = pressure range: 0-300 PSI

Voltage Suppression options available with these series:
Option-009, Option-012
T after series # indicates Titanium housing and
Hastelloy or Titanium sensor. (Except 750)

Series 300-ABC-D0EEEE, 320-ABC-D0EEEE,
330-ABC-D0EEEE, 335-ABC-D0EEEE
A = pressure type: 1,3
B = excitation/output: 3,4
C = pressure connection: 0
D = electrical connection: 0
EEEE = pressure range: 0-300 PSI

Voltage Suppression options available with these series:
Option-009, Option-012
T after series # indicates Titanium housing and
Hastelloy or Titanium sensor.

Entity Parameters (B = 2,3,4,5) Entity Parameters (B = 7)
 $V_{max} = 28V$ $V_{max} = 28V$
 $I_{max} = 110mA$ $I_{max} = 50mA$
 $C_i = 0.064\mu F$ $C_i = 0.064\mu F$
 $L_i = 0$ $L_i = 0$
 $P_{max} = 1W$ $P_{max} = 1W$

Entity Parameters (B=1)
 $V_{max} = 18.7V$
 $I_{max} = 293mA$
 $C_i = 0$
 $L_i = 0$

WARNING:

THIS PART IS USED IN AN AGENCY APPROVED ASSEMBLY.
REVISIONS MUST BE SUBMITTED FOR AGENCY APPROVAL.

DRAWN	CHECKED	ENGINEER	APPROVED
CHF	JL 1/1	SMK	
4/24/00	8/5/02	8/5/02	
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES			
INCHES	MILLIMETERS	ANGLE +/-3	
.XX 0.03	.X 0.8	BREAK SHARP EDGES APPROX .005/.010	
.XXX 0.005	.XX 0.13		
ALL DIMENSIONS APPLICABLE AFTER SURFACE TREATMENT		SURFACE FINISH 63	
HEAT TREATMENT		CODE IDENT NO	
MATERIAL SPEC		DWG SCALE NTS	



PRESSURE SYSTEMS
34 RESEARCH DRIVE • HAMPTON, VA. 23666

DRAWING TITLE
CERTIFICATION DRAWING
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DRAWING LAST UPDATED
DATE: 08/01/02
TIME: 14:40:00
BY: CHF

DRAWING NO	REVISION
TA-6610	H
PSI STOCK NO	DO NOT SCALE DRAWING
SHEET 1/5	

DATE	REV	ECO	REVISION	BY	CHK	EOR
12/20/01	A	3463	ADDED SERIES 35, 335 & 735; ADDED VOLTAGE SUPPRESSION OPTIONS.	CHF		SMK
2/6/02	B	N/A	ADDED T SUFFIX TO SERIES # FOR TITANIUM OPTION.	CHF		SMK
3/4/02	C	3498	ADDED MV OUTOUT DIAGRAM.	CHF		SMK
3/19/02	D	3498	REVISE EXCITATION OUTPUT 7.	CHF		SMK
6/13/02	E	3496	ADD SERIES 500 & 510 INFORMATION.	CHF		SMK
6/19/02	F	3496	REVISE SERIES 500 & 510 INFORMATION.	CHF		SMK
7/2/02	G	N/A	TITANIUM OPTION WAS NOT SHOWN FOR SERIES 500,510.	CHF		SMK
8/1/02	H	N/A	REVISED NOTES 7,8 & 9 FOR SERIES 500,510.	CHF		SMK

**Class I, II, III, Div. 1
Groups A-G
Hazardous Location**

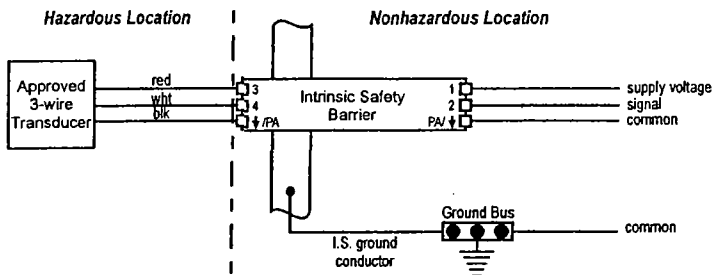


Figure 4. Wiring diagram for 3-wire, 0-5V output.
(see note 2 and all sectional notes)

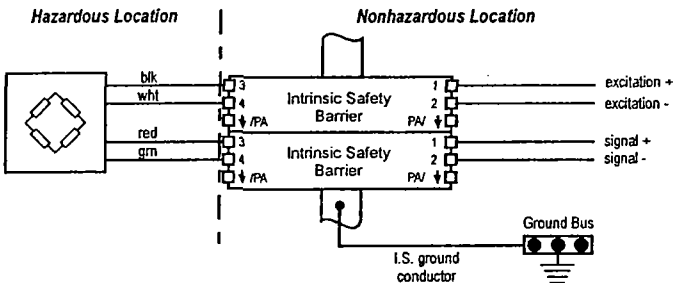


Figure 5. Wiring diagram for 4-wire, mV output.
(see note 3 and all sectional notes)

Notes:

1. Associated Apparatus shall provide intrinsically safe connections which meet the following parameters.

$$\begin{aligned} V_T &\leq V_{\max} & C_A &\geq C_T + C_{\text{leads}} \\ I_T &\leq I_{\max} & L_A &\geq L_T + L_{\text{leads}} \\ P_T &< P_{\max} \end{aligned}$$

2. Recommended Associated Apparatus as follows:

Mfg.	Model No.	Figure
R. Stahl	9001/01-280-100-10	2
R. Stahl	9001/51-280-110-14	1
R. Stahl	9002/13-280-110-00	1
R. Stahl	9303/11-22-11	3
R. Stahl	9002/11-280-293-00	4
R. Stahl	9001/01-280-50-10	2

B = 4
B = 3
B = 7

3. Recommended Associated Apparatus as follows:

Mfg.	Model No.	Leads
R. Stahl	9002/22-093-040-00	Signal
R. Stahl	9002/10-187-270-00	Excitation B = 1
R. Stahl	9002/11-280-293-00	Excitation B = 2 or 5

4. Control Room apparatus shall not generate in excess of 250V (U_{\max}).

5. Installation should be in accordance with Article 504 in the *National Electrical Code*, ANSI/NFPA 70

WARNING:

THIS PART IS USED IN AN AGENCY APPROVED ASSEMBLY.
REVISIONS MUST BE SUBMITTED FOR AGENCY APPROVAL.

DRAWN	CHECKED	ENGINEER	APPROVED
CHF	X.L.H.	SPK	
4/24/00	9/5/02	8/5/02	
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES			
INCHES	MILLIMETERS	ANGLE +/-3	
.XX 0.03	.X 0.8	BREAK SHARP EDGES	
.XXX 0.005	.XX 0.13	APPROX. .005/.010	
ALL DIMENSIONS APPLICABLE AFTER SURFACE TREATMENT		SURFACE FINISH	
HEAT TREATMENT		CODE IDENT NO	
MATERIAL SPEC		DWG SCALE	
		NTS	



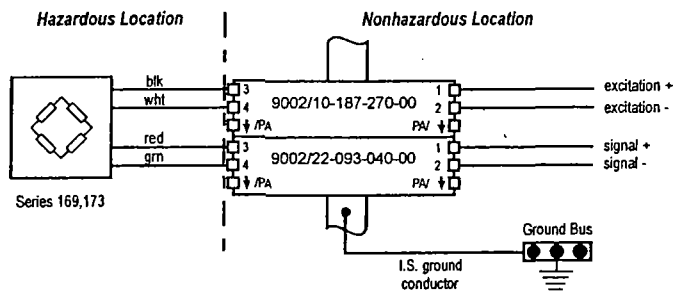
PRESSURE SYSTEMS
34 RESEARCH DRIVE • HAMPTON, VA. 23666

DRAWING TITLE
CERTIFICATION DRAWING
UL

DRAWING LAST UPDATED
DATE: 08/01/02
TIME: 14:40:00
BY: CHF

DRAWING NO	REVISION
TA-6610	H
PSI STOCK NO	DO NOT SCALE DRAWING
	SHEET 2/5

DATE	REV	ECO	REVISION	BY	CHK	EOR
12/20/01	A	3463	ADDED SERIES 35, 335 & 735; ADDED VOLTAGE SUPPRESSION OPTIONS.	CHF		SMK
2/6/02	B	N/A	ADDED T SUFFIX TO SERIES # FOR TITANIUM OPTION.	CHF		SMK
3/4/02	C	3498	ADDED MV OUTOUT DIAGRAM.	CHF		SMK
3/19/02	D	3498	REVISE EXCITATION OUTPUT 7.	CHF		SMK
6/13/02	E	3496	ADD SERIES 500 & 510 INFORMATION.	CHF		SMK
6/19/02	F	3496	REVISE SERIES 500 & 510 INFORMATION.	CHF		SMK
7/2/02	G	N/A	TITANIUM OPTION WAS NOT SHOWN FOR SERIES 500,510.	CHF		SMK
8/1/02	H	N/A	REVISED NOTES 7,8 & 9 FOR SERIES 500,510.	CHF		SMK



Wiring diagram for 4-wire, mV output.
(see note 2 and all sectional notes)

The Series 169 and 173 Depth Transducers are designed for installation in a Class I, Division 1, Groups A, B, C and D, Class II, Division 1, Groups E, F, and G, Class III, Division 1 hazardous location when connected to Associated Apparatus as described in note 1.

Series 169-ABC-D0EEEE, 173-ABC-D0EEEE

A = pressure type: 1,3

B = excitation/output: 1

C = pressure connection: 2,0,B,C

D = electrical connection: 0,4

EEEE = pressure range: 0-300PSI

T after series # indicates Titanium housing and Hastelloy or Titanium sensor.

Entity Parameters

$$V_{max} = 18.7V$$

$$I_{max} = 293mA$$

$$C_i = 0$$

$$L_i = 0$$

Notes:

1. Associated Apparatus shall provide intrinsically safe connections which meet the following parameters.

$$V_T \leq V_{max} \quad C_a \geq C_i + C_{leads}$$

$$I_T \leq I_{max} \quad L_a \geq L_i + L_{leads}$$

2. Recommended Associated Apparatus as follows:

Mfg.	Model No.
R. Stahl	9002/10-187-270-00
R. Stahl	9002/22-093-040-00

3. Control Room apparatus shall not generate in excess of 250V (U_{max}).

4. Installation should be in accordance with Article 504 in the National Electric Code, ANSI/NFPA 70.

WARNING:

THIS PART IS USED IN AN AGENCY APPROVED ASSEMBLY.
REVISIONS MUST BE SUBMITTED FOR AGENCY APPROVAL.

DRAWN	CHECKED	ENGINEER	APPROVED
CHF	D.P.H.	Stahl	
4/24/00	8/5/02	8/5/02	
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES			
INCHES	MILLIMETERS	ANGLE +/-3	
.XX 0.03	.X 0.8	BREAK SHARP EDGES APPROX .005/.010	
.XXX 0.005	.XX 0.13		
ALL DIMENSIONS APPLICABLE AFTER SURFACE TREATMENT		SURFACE FINISH 63	
HEAT TREATMENT		CODE INDENT NO	
MATERIAL SPEC		DWG SCALE NTS	



PRESSURE SYSTEMS
34 RESEARCH DRIVE * HAMPTON, VA. 23666

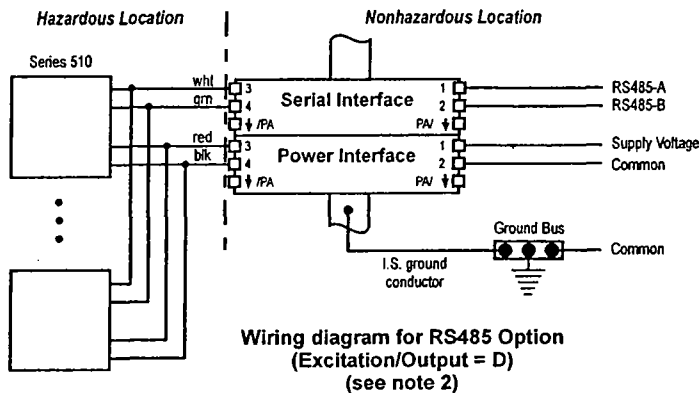
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TIME: 14:40:00
BY: CHF

DRAWING NO	REVISION
TA-6610	H
PSI STOCK NO	DO NOT SCALE DRAWING
	SHEET 3/5

DATE	REV	ECO	REVISION	BY	CHK	EOR
12/20/01	A	3463	ADDED SERIES 35, 335 & 735; ADDED VOLTAGE SUPPRESSION OPTIONS.	CHF		SMK
2/6/02	B	N/A	ADDED T SUFFIX TO SERIES # FOR TITANIUM OPTION.	CHF		SMK
3/4/02	C	3498	ADDED MV OUTOUT DIAGRAM.	CHF		SMK
3/19/02	D	3498	REVISE EXCITATION OUTPUT 7.	CHF		SMK
6/13/02	E	3496	ADD SERIES 500 & 510 INFORMATION.	CHF		SMK
6/19/02	F	3496	REVISE SERIES 500 & 510 INFORMATION.	CHF		SMK
7/2/02	G	N/A	TITANIUM OPTION WAS NOT SHOWN FOR SERIES 500,510.	CHF		SMK
8/1/02	H	N/A	REVISED NOTES 7,8 & 9 FOR SERIES 500,510.	CHF		SMK

**Class I, II, III, Div. 1
Groups A-G
Hazardous Location**



The Series 500,510 Depth Transducers are designed for installation in a Class I, Division 1, Groups A, B, C and D, Class II, Division 1, Groups E, F, and G, Class III, Division 1 hazardous location when connected to Associated Apparatus as described in note 1.

Series 500-ABC-D0EEEE, Series 510-ABC-D0EEEE

A = pressure type: 1,3,4
B = excitation/output: C,D
C = pressure connection: 2,0,B,C,1,4,6,7
D = electrical connection: 0,4
EEEE = pressure range: 0-300 PSIG
T after series # indicates Titanium housing and Hastelloy or Titanium sensor.

Entity Parameters:

Power interface (for 500 and 510)

$V_{max} = 28V$
 $I_{max} = 1A$
 $C_i = .002 \mu F$ (Per Sensor)
 $L_i = 0$

RS485 Interface (Per Channel)

$V_{max} = 28V$
 $I_{max} = 100mA$
 $C_i = .001 \mu F$ (Per Sensor)
 $L_i = 0$

SDI-12 Signal Interface

$V_{max} = 28V$
 $I_{max} = 200mA$
 $C_i = .002 \mu F$ (Per Sensor)
 $L_i = 0$

Notes:

1. Associated Apparatus shall provide intrinsically safe connections which meet the following parameters.

$$V_{OC} \leq V_{max} \quad C_a \geq C_i + C_{leads}$$

$$I_{SC} \leq I_{max} \quad L_a \geq L_i + L_{leads}$$

2. Recommended Associated Apparatus as follows:

Excitation/Output = D

Mfg.	Model No.
R. Stahl	Serial Interface: 9002/22-240-160-00
R. Stahl	Power Interface: 9001/01-158-390-10
	9001/01-199-270-10
	9001/01-280-100-10

3. Recommended Associated Apparatus as follows:

Excitation/Output = C

Mfg.	Model Number
R. Stahl	9002/11-280-293-00

WARNING:

THIS PART IS USED IN AN AGENCY APPROVED ASSEMBLY.
REVISIONS MUST BE SUBMITTED FOR AGENCY APPROVAL.

DRAWING LAST UPDATED
DATE: 08/01/02
TIME: 14:40:00
BY: CHF

DRAWN	CHECKED	ENGINEER	APPROVED
CHF	<i>CHF</i>	<i>SMK</i>	
4/24/00	8/5/02	8/5/02	
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES			
INCHES	MILLIMETERS	ANGLE +/-3	
.XX 0.03	.X 0.8	BREAK SHARP EDGES APPROX. .005/.010	
.XXX 0.005	.XX 0.13		
ALL DIMENSIONS APPLICABLE AFTER SURFACE TREATMENT		SURFACE FINISH 63	
HEAT TREATMENT		CODE IDENT NO	DRAWING NO
MATERIAL SPEC		DWG SCALE	REVISION
		NTS	H



PRESSURE SYSTEMS
34 RESEARCH DRIVE * HAMPTON, VA. 23666

DRAWING TITLE
CERTIFICATION DRAWING
UL

DRAWING NO

TA-6610

REVISION

PSI STOCK NO

DO NOT SCALE DRAWING

SHEET 4/5

DATE	REV	ECO	REVISION	BY	CHK	EOR
12/20/01	A	3463	ADDED SERIES 35, 335 & 735; ADDED VOLTAGE SUPPRESSION OPTIONS.	CHF		SMK
2/6/02	B	N/A	ADDED T SUFFIX TO SERIES # FOR TITANIUM OPTION.	CHF		SMK
3/4/02	C	3498	ADDED MV OUTOUT DIAGRAM.	CHF		SMK
3/19/02	D	3498	REVISE EXCITATION OUTPUT 7.	CHF		SMK
6/13/02	E	3496	ADD SERIES 500 & 510 INFORMATION.	CHF		SMK
6/19/02	F	3496	REVISE SERIES 500 & 510 INFORMATION.	CHF		SMK
7/2/02	G	N/A	TITANIUM OPTION WAS NOT SHOWN FOR SERIES 500,510.	CHF		SMK
8/1/02	H	N/A	REVISED NOTES 7,8 & 9 FOR SERIES 500,510.	CHF		SMK

Notes: (continued)

4. Control Room apparatus shall not generate in excess of 250V (U_{max}).
5. Installation should be in accordance with Article 504 in the *National Electric Code*, ANSI/NFPA 70.
6. Attached sensor cable meets requirement of NEC Article 500.30 (B) by the filler material maintaining separation between conductors >.02".
7. RS485A and RS485B are run together as a shielded twisted pair. If the conductor insulation is less than .01", the combined current of the serial interface barrier channels can not exceed I_{max} .
8. Supply voltage and common are run as a shielded twisted pair.
9. SDI-12 data line is run using a single conductor of a shielded twisted pair.
10. Total cable length allowable is the addition of all cable lengths attached to a barrier in any configuration.
11. All cabling must comply with NEC Article 500.30 (B).
12. If the electrical parameters of the cable are unknown, the following values may be used:
 - Capacitance - 60pF/ft
 - Inductance - 0.20 μ H/ft

WARNING:

THIS PART IS USED IN AN AGENCY APPROVED ASSEMBLY.
REVISIONS MUST BE SUBMITTED FOR AGENCY APPROVAL.

DRAWN	CHECKED	ENGINEER	APPROVED
CHF	<i>A. B. H.</i>	<i>gile</i>	
4/24/00	<i>9/5/02</i>	<i>8/5/02</i>	
UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES			
INCHES	MILLIMETERS	ANGLE +/-3	
.XX 0.03	.X 0.8	BREAK SHARP EDGES	
.XXX 0.005	.XX 0.13	APPROX .005/.010	
ALL DIMENSIONS APPLICABLE AFTER SURFACE TREATMENT		SURFACE FINISH	
HEAT TREATMENT		CODE IDENT NO	
MATERIAL SPEC		DWG SCALE	
		NTS	



PRESSURE SYSTEMS
34 RESEARCH DRIVE * HAMPTON, VA. 23666

DRAWING TITLE
CERTIFICATION DRAWING
UL

DRAWING LAST UPDATED
DATE: 08/01/02
TIME: 14:40:00
BY: CHF

DRAWING NO	REVISION
TA-6610	H
PSI STOCK NO	DO NOT SCALE DRAWING
	SHEET 5/5

WATER FLOW
TRANSMITTER



3-7000.090



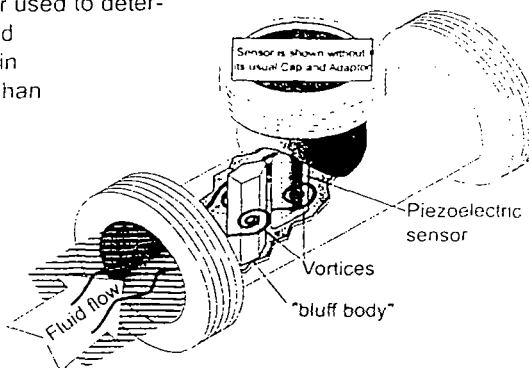
C-12/00 English

1. Mounting Location	1	7. Calibration - Current Output Models	5
2. Installation	1	8. Specifications	6
3. Wiring Preparation	2	9. Spare Parts	8
4. Wiring Options - Frequency Output Models	3	10. Sensor Ordering Tree	10
5. Calibration - Frequency Output Models	3	11. End Connectors Ordering Tree	10
6. Wiring Options - Current Output Models	4	12. Sensor Assembly Part Numbers	11

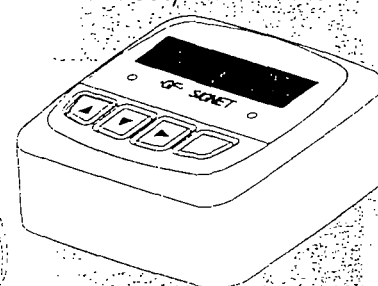
1. Mounting Location

Minimum upstream/downstream sensor mounting requirements:

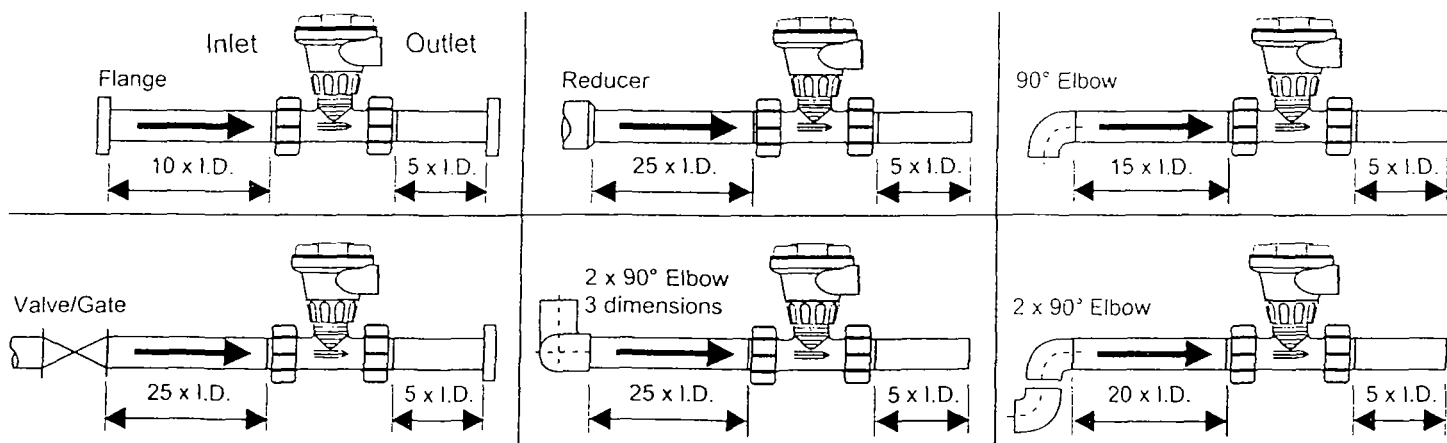
- The sensor must be mounted in a rigid pipe to minimize vibration. Always maximize distance between the sensor and pump source.
- Horizontal pipe runs: All mounting angles are acceptable. Avoid air bubbles.
- Vertical pipe runs: All mounting angles are acceptable, with upward flow preferred.
- A Reynold's Number is a dimensionless number used to determine the effects of viscosity, specific gravity, and velocity on flow sensor performance. To maintain system accuracy, a Reynold's Number greater than 7,500 is required.
 - Reynold's number = $3162.76 \times Q \times Sg / (\mu \times ID)$
 - where: Q = Flow Rate in GPM;
 - Sg = Specific Gravity;
 - μ = Dynamic Viscosity in Centipoise;
 - ID = inside diameter in inches
- Minimum downstream pipe backpressure levels (full pipes) are required to prevent cavitation within the sensor (section 8).



OPTION: Integral Transmitter (local readout)

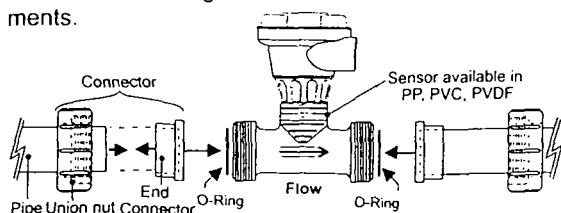


Order
+GF+ Signet
3-8550-1,
3-8550-2, or
3-8550-3



2. Installation

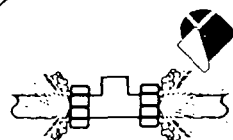
- Choose a mounting location that satisfies section 1 requirements.



- Install sensor with arrow pointing in the direction of flow. These flow sensors are not for bi-directional flow.

2.1 Fusion Socket or Solvent Cement Socket

- Fusion** socket version: available in HP PVDF, PVDF, or PP. A George Fischer Socket Fusion Joining Machine is required to install the end connectors on the pipeline. Refer to the joining machine manual for installation details.
- Solvent** socket version: available in PVC. Follow the PVC cement manufacturer's recommendations and instructions. Avoid excess cement in fitting joints to prevent port obstruction.

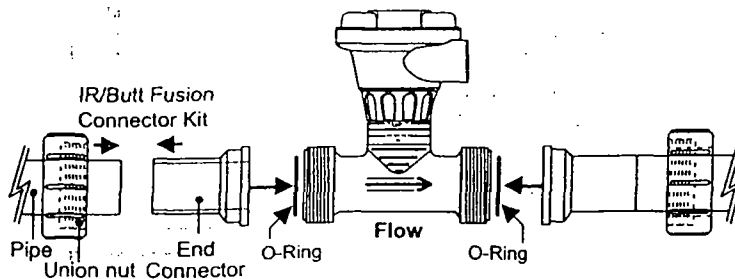


SAFETY INSTRUCTIONS

- Do not remove from pressurized lines.
- Never install sensor without O-Rings.
- Confirm chemical compatibility before use.
- Do not exceed maximum temperature/pressure specifications.
- Do not install/service without following mounting procedure.
- Wear safety goggles and faceshield during installation/service.
- Do not alter product construction.
- Failure to follow safety instructions could result in severe personal injury.

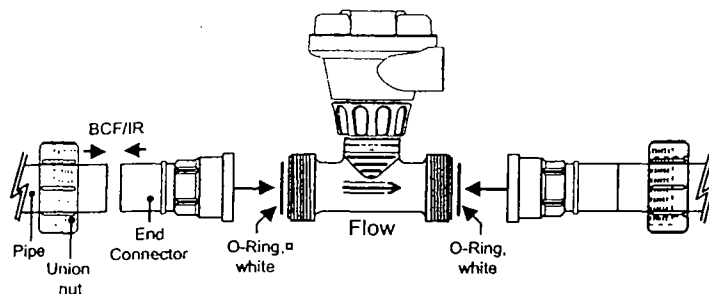
2.2 IR/Butt Fusion Sensors

- Available in PVDF or PP. A George Fischer IR weld or Butt Fusion Joining Machine is required to install the end connectors onto pipeline. Refer to the IR weld or butt fusion joining machine manual for installation details.



2.3 BCF/IR Sensors

- A George Fischer SYGEF HP BCF/IR Fusion Joining Machine is required to install the end connections. Refer to the SYGEF BCF/IR fusion joining machine manual for installation details.

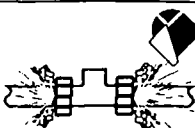


NOTE:

Union Connectors are sold separately (except for HP - High Purity.)

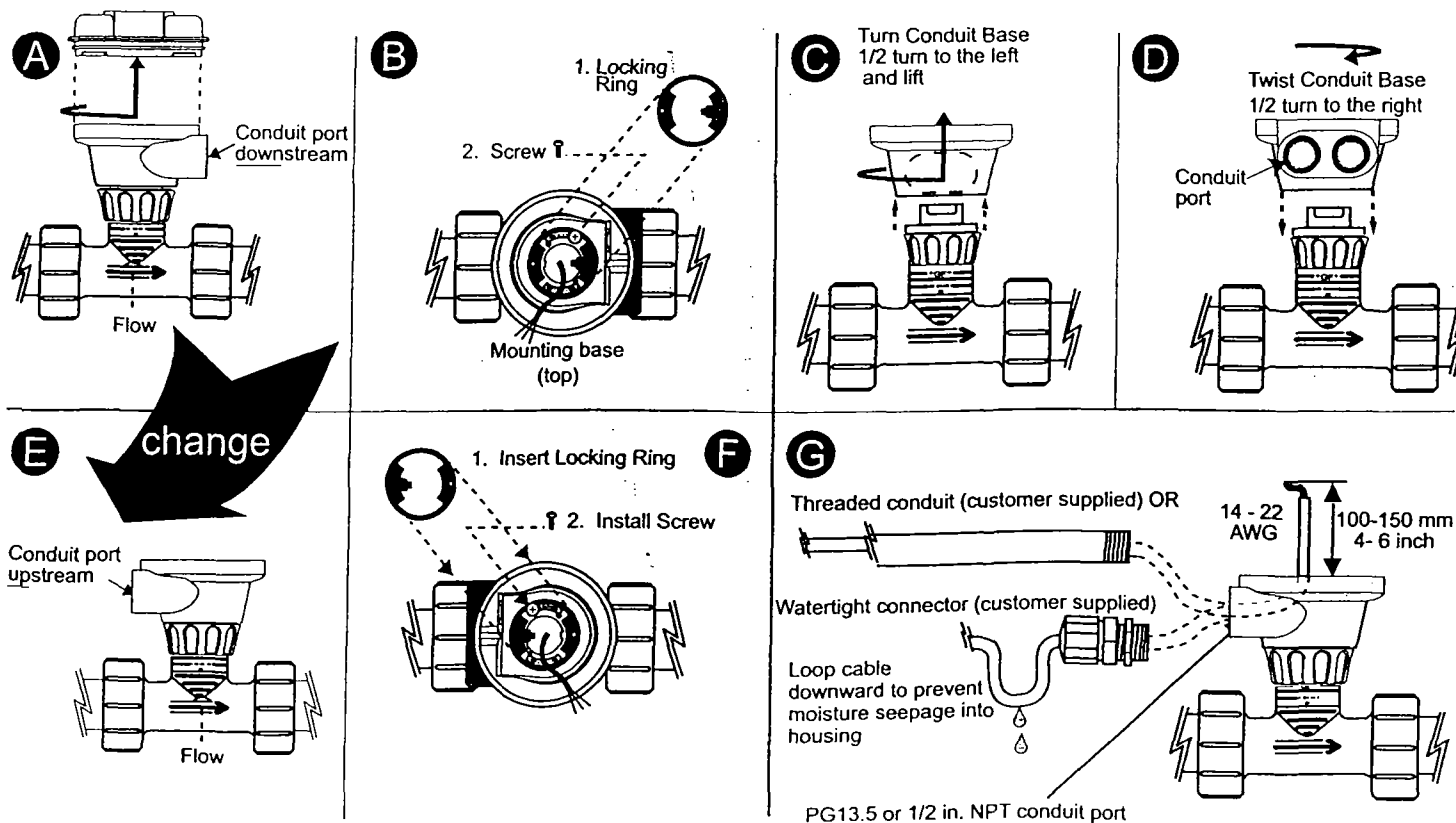
SAFETY INSTRUCTIONS

- Do not remove from pressurized lines.
- Never install sensor without O-Rings.
- Confirm chemical compatibility before use.
- Do not exceed maximum temperature/pressure specifications.
- Do not install/service without following mounting procedure.
- Wear safety goggles and faceshield during installation/service.
- Do not alter product construction.
- Failure to follow safety instructions could result in severe personal injury.



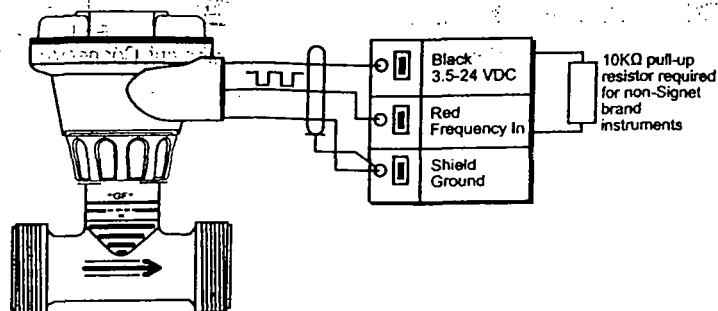
Wiring Preparation

The vortex sensor's cap base is reversible for either upstream or downstream conduit port orientation. **Optional:** Refer to steps (A to F) for conduit port reversal instructions. **Required:** Refer to steps (A to G) for external wiring requirements.

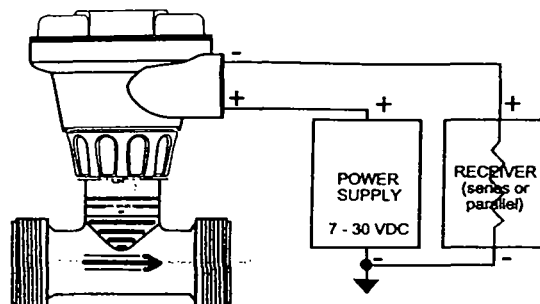


4. Wiring Options - Frequency Output Models

- DC sensor power supplied by +GF+ SIGNET instrument
- Use the 2535/2536 input card setting when wiring to the +GF+ SIGNET 9010 Inteltek-Pro Flow Controller



4-20mA Current Output Models



5. Calibration - Frequency Output Models

This sensor model provides an open-collector frequency output directly proportional to the flow rate. The following K-factors represent the number of pulses generated by the sensor for each engineering unit of water measured. If fluids other than water are used, then custom calibration is required.

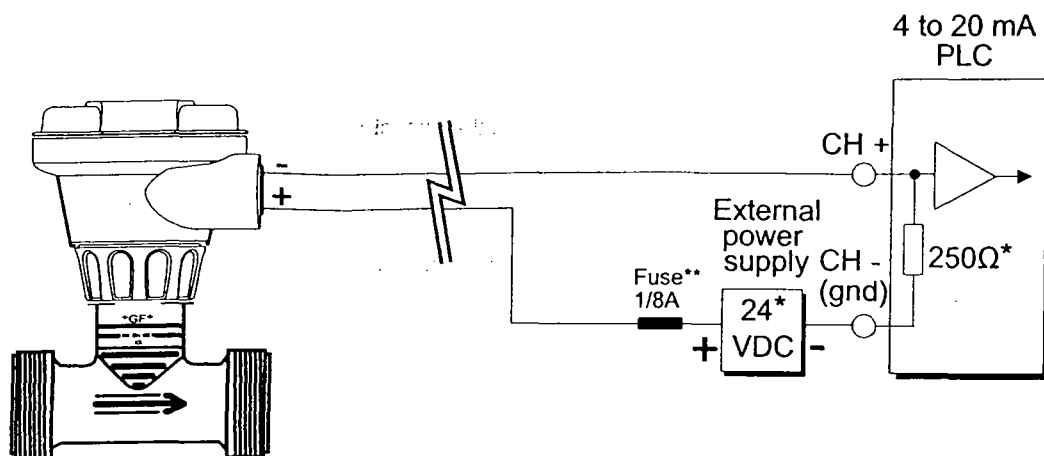
K-Factors - ANSI & Metric Piping Systems							
Sensor Material	Flow Units	d20 DN15 (-x1) (i.d.≈0.5 inch)	d25 DN20 (-x2) (i.d.≈0.75 inch)	d32 DN25 (-x3) (i.d.≈1 inch)	d40 DN32 (-x4) (i.d.≈1.25 inch)	d50 DN40 (-x5) (i.d.≈1.5 inch)	d63 DN50 (-x6) (i.d.≈2 inch)
PVC, SCH 80 3-7000-5x	U.S. Gallons	1837.39	802.34	361.30	138.76	88.296	39.133
	Liters	485.44	211.98	95.455	36.660	23.328	10.339
PVC, Metric 3-7000-6x	U.S. Gallons	1248.31	538.45	243.84	114.66	61.415	29.686
	Liters	329.81	142.26	64.422	30.292	16.226	7.843
PP, Metric 3-7000-4x	U.S. Gallons	1385.46	572.51	265.76	138.41	70.719	35.096
	Liters	366.04	151.26	70.213	36.568	18.684	9.272
PVDF, Metric 3-7000-2x	U.S. Gallons	1381.71	582.63	265.97	111.81	50.732	25.443
	Liters	365.05	153.93	70.270	29.540	13.403	6.722
HP PVDF BCF/IR Spigot (-0x)	U.S. Gallons	1396.90	575.71	254.11	110.86	50.431	25.537
	Liters	369.07	152.10	67.137	29.288	13.324	6.747
HP PVDF BCF/IR Union (-1, -3x)	U.S. Gallons	1400.00	575.70	254.31	110.48	51.855	25.568
	Liters	369.88	152.10	67.190	29.188	13.700	6.755

K-factor Conversion Formulas:

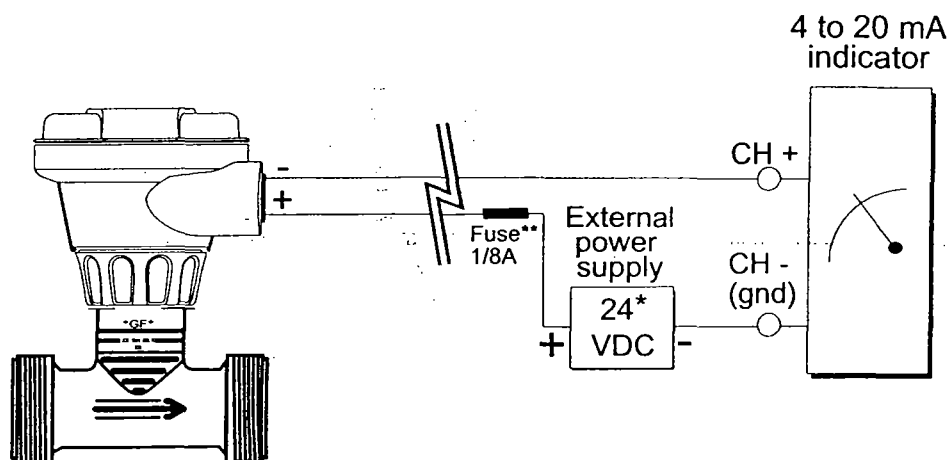
1 U.S. gallon =	0.003785 cubic meters
1 U.S. gallon =	0.0000003069 acre feet
1 U.S. gallon =	8.3454 pounds of water
1 U.S. gallon =	3.785 liters
1 U.S. gallon =	0.8327 imperial gallons

6. Wiring Options - Current Output Models

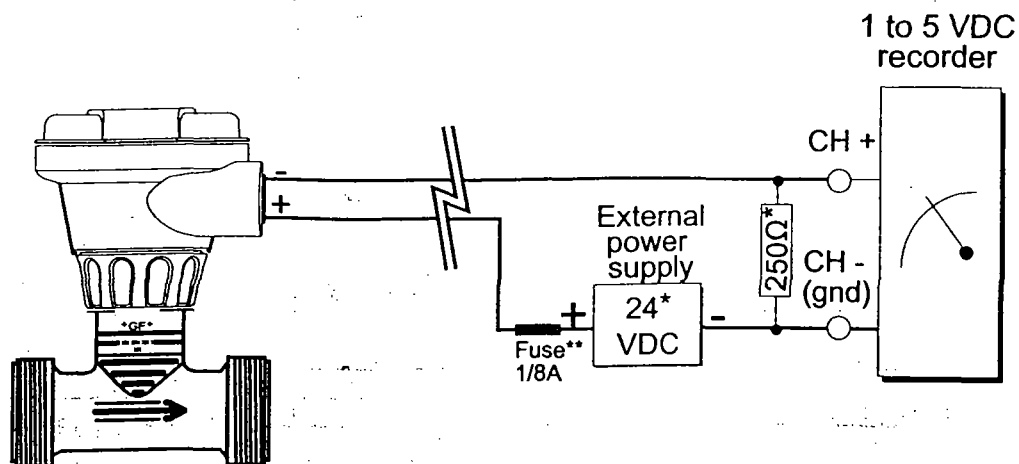
- PLC **without** an internal transmitter power supply



- PLC with a 4 to 20 mA indicator



- PLC with a 1 to 5 VDC chart recorder



* Refer to the maximum Loop Impedance for minimum operating voltage requirements in the Specifications section.

** 1/8 Amp. fuse recommended (customer supplied)

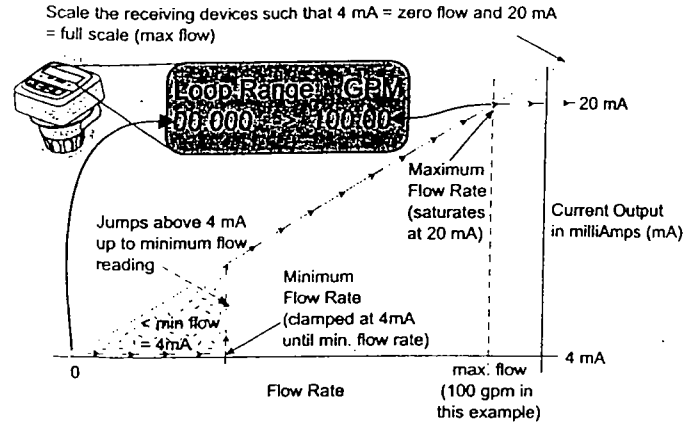
7. Calibration - Current Output Models

This sensor model outputs a 4 to 20 mA current signal directly proportional to the flow rate. The current output is held at 4 mA when flow is less than the minimum velocity specification, and increases to 20 mA at the maximum flow velocity specification, see section 8. Use the following formula to calculate the expected current output level at a specific flow velocity.

$$\left(\frac{\text{Fluid velocity in pipe}}{\text{Max sensor velocity (section 8)}} \times 16 \right) + 4 = \text{Expected current output (mA)}$$

Example: In a pipe with a flow velocity of 2 m/s, the expected current output is calculated as 12.0 mA.

$$\left(\frac{2 \text{ (m/s)}}{4 \text{ (m/s)}} \times 16 \right) + 4 = 12.0 \text{ mA}$$



OPERATIONAL SCENARIO: At low flow (below minimum flow rate for this sensor), sensor output is 4 mA. The instant the flow rate exceeds the minimum, the output jumps to reflect the min. measurable flow rate. At max. flow rate, output peaks at 20 mA.

7.1 Velocity to Rate or Rate to Velocity Conversion Formulas

A. Metric Conversion Formulas	V = flowrate v = known flow velocity	V (lpm) to v (m/s) $v = V / (di^2 \cdot 0.0471)$	Optional: v (m/s) to V (lpm) $V = v \cdot di^2 \cdot 0.0471$
EXAMPLES:			
lpm to m/s:	PVDF, sensor d63 with a known flowrate V = 200 lpm (di = 55 from table below); $v(\text{m/s}) = 200 / (55^2 \cdot 0.0471) = 1.40$		
m/s to lpm: (optional)	PVC sensor, d32 with a known flow velocity v = 2 m/s (di = 26 from table below); $V(\text{lpm}) = 2 \cdot 26^2 \cdot 0.0471 = 63.68$		

B. American Conversion Formulas	V = flowrate v = known flow velocity	V (gpm) to v (ft/s) $v = V / (di^2 \cdot 0.0038)$	Optional: v (ft/s) to V (gpm) $V = v \cdot di^2 \cdot 0.0038$
EXAMPLES:			
gpm to ft/s:	PVDF, sensor d63 with a known flowrate V = 100 gpm (di = 55 from table below); $v(\text{ft/s}) = 100 / (55^2 \cdot 0.0038) = 8.7$		
ft/s to gpm: (optional)	PVC sensor, d32 with a known flow velocity v = 10 ft/s (di = 26 from table below); $V(\text{gpm}) = 10 \cdot 26^2 \cdot 0.0038 = 25.69$		

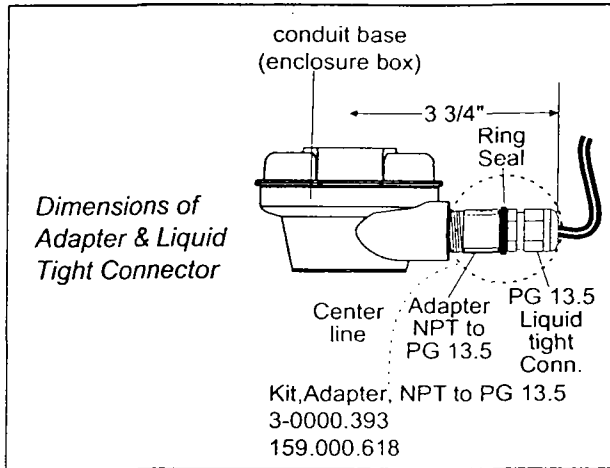
1 lpm = 0.264 gpm 1 m/s = 3.28 ft/s

Sensors	Pipe Size	Metric Conversion Data				American Conversion Data			
		Min Flow		Max Flow		Min Flow		Max Flow	
		v (m/s)	V (lpm)	v (m/s)	V (lpm)	v (ft/s)	V (gpm)	v (ft/s)	V (gpm)
PVDF / HP PVDF	d20 DN15	0.50	4.98	4.00	39.66	1.64	1.32	13.12	10.48
	d25 DN20	0.50	8.94	4.00	71.70	1.64	2.36	13.12	18.94
	d32 DN25	0.40	11.76	4.00	117.78	1.31	3.11	13.12	31.12
	d40 DN32	0.40	21.18	4.00	211.56	1.31	5.60	13.12	55.89
	d50 DN40	0.30	26.76	4.00	356.70	0.98	7.07	13.12	94.24
	d63 DN50	0.30	42.78	4.00	570.18	0.98	11.30	13.12	150.64
PP	d20 DN15	0.50	4.98	4.00	39.66	1.64	1.32	13.12	10.48
	d25 DN20	0.50	8.94	4.00	71.70	1.64	2.36	13.12	18.94
	d32 DN25	0.40	11.76	4.00	117.78	1.31	3.11	13.12	31.12
	d40 DN32	0.40	18.12	4.00	181.14	1.31	4.79	13.12	47.86
	d50 DN40	0.30	21.48	4.00	286.68	0.98	5.68	13.12	75.74
	d63 DN50	0.30	34.62	4.00	461.88	0.98	9.15	13.12	122.03
PVC Schedule 80	1/2 in.	0.50	4.29	4.00	31.86	1.64	1.13	13.12	8.42
	3/4 in.	0.50	7.63	4.00	57.73	1.64	2.02	13.12	15.25
	1 in.	0.40	9.97	4.00	95.43	1.31	2.63	13.12	25.21
	1 1/4 in.	0.40	18.70	4.00	181.14	1.31	4.94	13.12	47.86
	1 1/2 in.	0.30	19.35	4.00	251.12	0.98	5.11	13.12	66.35
	2 in.	0.30	32.57	4.00	425.29	0.98	8.61	13.12	112.36
PVC Metric	d20 DN15	0.50	5.28	4.00	42.42	1.64	1.39	13.12	11.21
	d25 DN20	0.50	9.42	4.00	75.42	1.64	2.49	13.12	19.93
	d32 DN25	0.40	12.72	4.00	127.44	1.31	3.36	13.12	33.67
	d40 DN32	0.40	20.52	4.00	205.26	1.31	5.42	13.12	54.23
	d50 DN40	0.30	23.76	4.00	316.86	0.98	6.28	13.12	83.71
	d63 DN50	0.30	38.22	4.00	509.70	0.98	10.10	13.12	134.66

8. Specifications

Backpressure Calculation

- Minimum downstream pipe backpressure levels (full pipes) are required to prevent cavitation within the sensor. The minimum back pressure is calculated by the following formula: $2.7 \times \Delta P + 1.3 \times P_o$ (ΔP = Pressure drop across sensor. P_o = Water saturation vapor pressure at operating temperature.)
- Using Pressure Drop Graph, find ΔP by locating your maximum flow rate on specific sensor size line.
- Using the Water Saturation Vapor Pressures Chart, find P_o at operating temperature.
- Calculate minimum back pressure needed using formula.



Technical Data

Accepted materials:

- Sensor: PVC, PP, PVDF, or SYGEF HP PVDF
- Union O-Rings: FPM or EPDM

Pipe size range:

- PP/PVDF, Metric: d20 to 63 mm, DN15 to 50 mm
- PVC, SCH 80: 0.5 to 2.0 in.

Flow range:

- d20 to d25 (0.5 to 0.75 in.) sensors: 0.5 to 4 m/s (1.6 to 13 ft/s)
- d32 to d40 (1.0 to 1.25 in.) sensors: 0.4 to 4 m/s (1.3 to 13 ft/s)
- d50 to d63 (1.5 to 2.0 in.) sensors: 0.3 to 4 m/s (1.0 to 13 ft/s)

NOTE: Below these velocity ranges, Vortex output is non-linear.

Enclosure:

- Rating: NEMA 4X/IP65
- Material: PC/PBT blend of resins
- Seals (2): Buna-N

Electrical:

- Accuracy: $\pm 1\%$ of reading @ 25 °C
- Repeatability: $\pm 0.5\%$ of reading @ 25 °C
- Immunity: EN50082-2
- Emissions: EN55011
- Reverse polarity protection

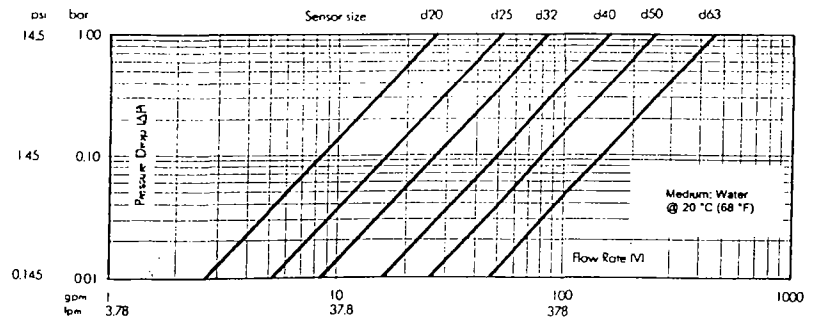
Electrical - Frequency Output Model

- Power: 3.5 to 24 VDC, regulated, 1.5 mA max
- Output type: Open-collector NPN transistor, 5 mA max sink,
- 24 VDC max pull-up voltage, 0 to 300 Hz (size dependent), 50% duty cycle, non-isolated

Electrical - Current Output Model

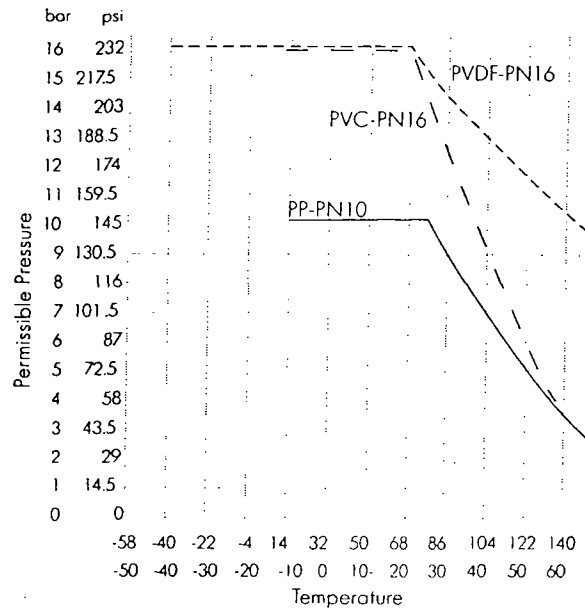
- Power: 7 to 30 VDC, regulated, 20 mA max

Pressure Drop Graph



Water Saturation Vapor Pressures at Operation Temperatures

°C	-20	-10	0	10	20	25	30	40	50	65
°F	-4	14	32	50	68	77	86	104	122	149
P_o (bar)	0.001	0.003	0.006	0.012	0.023	0.32	0.042	0.074	0.123	0.25
P_o (psia)	0.014	0.038	0.088	0.178	0.338	0.458	0.614	1.067	1.784	3.626



Current loop (2-wire):

- Loop impedance: 1 Ω maximum at 7 VDC
300 Ω maximum at 12 VDC
800 Ω maximum at 24 VDC
1000 Ω maximum at 30 VDC

- 4 to 20 mA output fixed from 0 to 13 ft/s

- Resolution: 6 μ A

Environmental

Maximum media press./temp.:

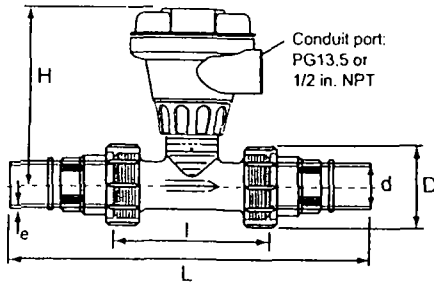
- PVDF: 16 bar @ 0 °C, 9.8 bar @ 65 °C
(232 psi @ 32 °F, 144 psi @ 149 °F)
- PP: 10 bar @ 0 °C, 2.9 bar @ 65 °C
(145 psi @ 32 °F, 42 psi @ 149 °F)
- PVC: 16.2 bar @ 0 °C, 3.7 bar @ 60 °C
(235 psi @ 32 °F, 54 psi @ 140 °F)
- Ambient temp.: 0 to 65 °C (32 to 149 °F)
- Storage temp.: -15 to 80 °C (5 to 176 °F)
- Relative humidity: 0 to 95%, non-condensing
- Max. vibration: 1 mm or 1g double amplitude @ 500 Hz

Standards and Approvals

- Manufactured under ISO 9001 and ISO 14001
- CE

Dimensions

HP BCF/IR True Union

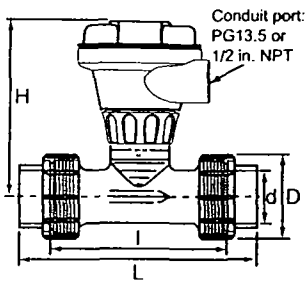


HP BCF/IR True Union

d	Closest	DN	D		L		I		H		e
mm	inch size	mm	mm	inch	mm	inch	mm	inch	mm	inch	mm
20	1/2	15	47	1.85	226	8.90	90	3.54	117	4.61	1.9
25	3/4	20	57	2.24	236	9.29	100	3.94	120	4.72	1.9
32	1	25	64	2.52	248	9.76	110	4.33	123	4.84	2.4
40	1-1/4	32	78	3.07	286	11.26	110	4.33	127	5.00	2.4
50	1-1/2	40	89	3.50	298	11.73	120	4.72	132	5.20	3.0
63	2	50	109	4.29	317	12.48	130	5.12	139	5.47	3.0

- HP BCF/IR True Union supplied with white FPM o-rings.
- All HP Sensors are 100% cleaned, inspected and double-bagged in heat-sealed PA6/PE liners.

HP Socket Fusion True Union PVDF Socket Fusion PP Socket Fusion



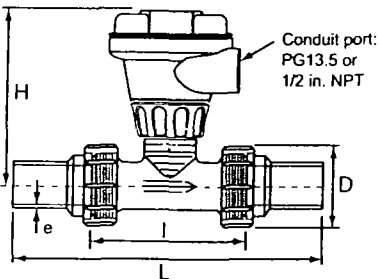
Dimension L \pm 3 mm (\pm 0.1 in.)

HP Socket Fusion True Union; PVDF and PP, Socket Fusion

d	Closest	DN	D		L		I		H		e
mm	inch size	mm	mm	inch	mm	inch	mm	inch	mm	inch	mm
20	1/2	15	47	1.85	128	5.04	90	3.54	117	4.61	1.9
25	3/4	20	57	2.24	142	5.59	100	3.94	120	4.72	1.9
32	1	25	64	2.52	156	6.14	110	4.33	123	4.84	2.4
40	1-1/4	32	78	3.07	160	6.30	110	4.33	127	5.00	2.4
50	1-1/2	40	89	3.50	176	6.93	120	4.72	132	5.20	3.0
63	2	50	109	4.29	194	7.64	130	5.12	139	5.47	3.0

- HP Socket Fusion True Union supplied with black FPM o-rings.
- All HP Sensors are 100% cleaned, inspected and double-bagged in heat-sealed PA6/PE liners.

PVDF Butt Fusion / IR PP Butt Fusion / IR



Dimension L \pm 3 mm (\pm 0.1 in.)

Shown with Butt Fusion/IR connectors

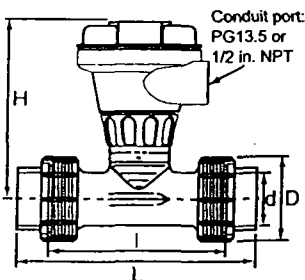
PVDF & PP Butt Fusion/IR connectors

d	Closest	DN	D		L		I		H		e
mm	inch size	mm	mm	inch	mm	inch	mm	inch	mm	inch	mm
20	1/2	15	47	1.85	196	7.72	90	3.54	117	4.61	1.9
25	3/4	20	57	2.24	212	8.35	100	3.94	120	4.72	1.9
32	1	25	64	2.52	228	8.98	110	4.33	123	4.84	2.4
40	1-1/4	32	78	3.07	234	9.21	110	4.33	127	5.00	2.4
50	1-1/2	40	89	3.50	250	9.84	120	4.72	132	5.20	3.0
63	2	50	109	4.29	266	10.47	130	5.12	139	5.47	3.0

PVC Sch 80 Solvent Socket

Inch size		D		L		I		H		e
		mm	inch	mm	inch	mm	inch	mm	inch	mm
1/2		43	1.69	128	5.04	90	3.54	117	4.61	1.9
3/4		53	2.09	144	5.67	100	3.94	120	4.72	1.9
1		60	2.36	160	6.30	110	4.33	123	4.84	2.4
1-1/4		74	2.91	168	6.61	110	4.33	127	5.00	2.4
1-1/2		83	3.27	188	7.40	120	4.72	132	5.20	3.0
2		103	4.06	212	8.35	130	5.12	139	5.47	3.0

PVC Sch 80 Solvent Socket; PVC Metric Solvent Socket

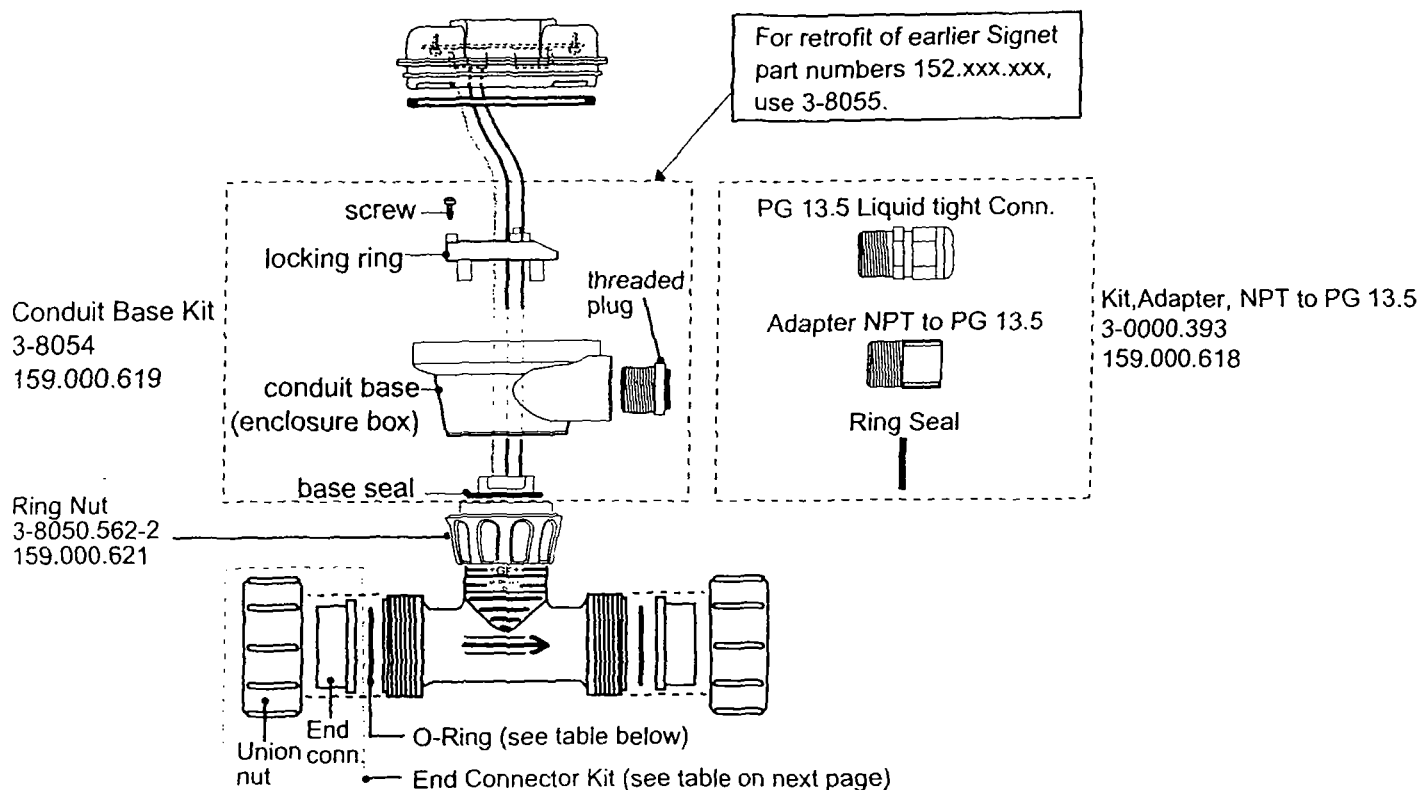


Dimension L \pm 3 mm (\pm 0.1 in.)

PVC Metric Solvent Socket

d	Closest	DN	D		L		I		H		e
mm	inch size	mm	mm	inch	mm	inch	mm	inch	mm	inch	mm
20	1/2	15	43	1.69	136	5.35	90	3.54	117	4.61	1.9
25	3/4	20	53	2.09	150	5.91	100	3.94	120	4.72	1.9
32	1	25	60	2.36	166	6.54	110	4.33	123	4.84	2.4
40	1-1/4	32	74	2.91	166	6.54	110	4.33	127	5.00	2.4
50	1-1/2	40	83	3.27	186	7.32	120	4.72	132	5.20	3.0
63	2	50	103	4.06	196	7.72	130	5.12	139	5.47	3.0

9. Spare Parts



NOTE: For Sensor part numbers, see pages 10 and 11

Spare O-Rings

Description	Size (mm)	Material	Mfr. Part No. (2 pieces)	Code (1 piece. order 2 pcs.)
O-Ring(s) [1 or 2 pieces]	d20	EPDM	3-7000.390-01	748.410.038
O-Ring(s) [1 or 2 pieces]	d25	EPDM	3-7000.390-02	748.410.044
O-Ring(s) [1 or 2 pieces]	d32	EPDM	3-7000.390-03	748.410.195
O-Ring(s) [1 or 2 pieces]	d40	EPDM	3-7000.390-04	748.410.052
O-Ring(s) [1 or 2 pieces]	d50	EPDM	3-7000.390-05	748.410.134
O-Ring(s) [1 or 2 pieces]	d63	EPDM	3-7000.390-06	748.410.135
O-Ring(s) [1 or 2 pieces]	d20	FPM (Viton)	3-7000.390-07	749.410.038
O-Ring(s) [1 or 2 pieces]	d25	FPM (Viton)	3-7000.390-08	749.410.044
O-Ring(s) [1 or 2 pieces]	d32	FPM (Viton)	3-7000.390-09	749.410.195
O-Ring(s) [1 or 2 pieces]	d40	FPM (Viton)	3-7000.390-10	749.410.052
O-Ring(s) [1 or 2 pieces]	d50	FPM (Viton)	3-7000.390-11	749.410.134
O-Ring(s) [1 or 2 pieces]	d63	FPM (Viton)	3-7000.390-12	749.410.135
O-Ring(s) [1 or 2 pieces]	d20	FPM white	3-7000.390-13	749.410.005
O-Ring(s) [1 or 2 pieces]	d25	FPM white	3-7000.390-14	749.410.006
O-Ring(s) [1 or 2 pieces]	d32	FPM white	3-7000.390-15	749.410.120
O-Ring(s) [1 or 2 pieces]	d40	FPM white	3-7000.390-16	749.410.062
O-Ring(s) [1 or 2 pieces]	d50	FPM white	3-7000.390-17	749.410.172
O-Ring(s) [1 or 2 pieces]	d63	FPM white	3-7000.390-18	749.410.054

9. Spare Parts (continued)

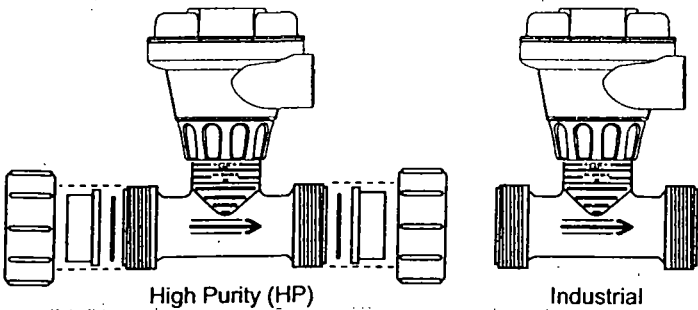
Spare End Connectors

Size	END CONNECTOR Material	Mfr. Part No.	Code	
			End Connector Single piece	Union Nut Single piece
		Complete Kit: 2 ring nuts 2 end connectors		
d20	PVDF, Metric, Butt Fusion, 1/2"	3-7000.391-11	721.602.006	721.690.006
d25	PVDF, Metric, Butt Fusion, 3/4"	3-7000.391-12	721.602.007	721.690.007
d32	PVDF, Metric, Butt Fusion, 1"	3-7000.391-13	721.602.008	721.690.008
d40	PVDF, Metric, Butt Fusion, 1 1/4"	3-7000.391-14	721.602.009	721.690.009
d50	PVDF, Metric, Butt Fusion, 1 1/2"	3-7000.391-15	721.602.010	721.690.010
d63	PVDF, Metric, Butt Fusion, 2"	3-7000.391-16	721.602.011	721.690.011
d20	PVDF, Metric, Fusion Socket, 1/2"	3-7000.391-21	721.600.106	721.690.006
d25	PVDF, Metric, Fusion Socket, 3/4"	3-7000.391-22	721.600.107	721.690.007
d32	PVDF, Metric, Fusion Socket, 1"	3-7000.391-23	721.600.108	721.690.008
d40	PVDF, Metric, Fusion Socket, 1 1/4"	3-7000.391-24	721.600.109	721.690.009
d50	PVDF, Metric, Fusion Socket, 1 1/2"	3-7000.391-25	721.600.110	721.690.010
d63	PVDF, Metric, Fusion Socket, 2"	3-7000.391-26	721.600.111	721.690.011
d20	PP Metric, Butt Fusion, 1/2"	3-7000.391-31	727.600.106	727.690.406
d25	PP Metric, Butt Fusion, 3/4"	3-7000.391-32	727.600.107	727.690.407
d32	PP Metric, Butt Fusion, 1"	3-7000.391-33	727.600.108	727.690.408
d40	PP Metric, Butt Fusion, 1 1/4"	3-7000.391-34	727.600.109	727.690.409
d50	PP Metric, Butt Fusion, 1 1/2"	3-7000.391-35	727.600.110	727.690.410
d63	PP Metric, Butt Fusion, 2"	3-7000.391-36	727.600.111	727.690.411
d20	PP Metric, Fusion Socket, 1/2"	3-7000.391-41	727.608.506	727.690.406
d25	PP Metric, Fusion Socket, 3/4"	3-7000.391-42	727.608.507	727.690.407
d32	PP Metric, Fusion Socket, 1"	3-7000.391-43	727.608.508	727.690.408
d40	PP Metric, Fusion Socket, 1 1/4"	3-7000.391-44	727.608.509	727.690.409
d50	PP Metric, Fusion Socket, 1 1/2"	3-7000.391-45	727.608.510	727.690.410
d63	PP Metric, Fusion Socket, 2"	3-7000.391-46	727.608.511	727.690.411
d20	PVC Sch80, 1/2"	3-7000.391-51	735.600.106	735.690.406
d25	PVC Sch80, 3/4"	3-7000.391-52	735.600.107	735.690.407
d32	PVC Sch80, 1"	3-7000.391-53	735.600.108	735.690.408
d40	PVC Sch80, 1 1/4"	3-7000.391-54	735.600.109	735.690.409
d50	PVC Sch80, 1 1/2"	3-7000.391-55	735.600.110	735.690.410
d63	PVC Sch80, 2"	3-7000.391-56	735.600.111	735.690.411
d20	PVC Metric, 1/2"	3-7000.391-61	735.608.606	735.690.406
d25	PVC Metric, 3/4"	3-7000.391-62	735.608.607	735.690.407
d32	PVC Metric, 1"	3-7000.391-63	735.608.608	735.690.408
d40	PVC Metric, 1 1/4"	3-7000.391-64	735.608.609	735.690.409
d50	PVC Metric, 1 1/2"	3-7000.391-65	735.608.610	735.690.410
d63	PVC Metric, 2"	3-7000.391-66	735.608.611	735.690.411

10. Sensor Ordering Tree

To select a replacement sensor:

- a) determine if your sensor has a pulse (frequency) or current output;
- b) determine material type and configuration;
- c) determine size.



OUTPUT

0	Frequency Output
1	Current Output (4 to 20 mA)

3- 7000 . m s

MAT'L./CONFIG.

1	*SYGEF HP-PVDF BCF/R Butt Fusion True Union (end connectors included)▯
2	*SYGEF HP-PVDF BCF/R Socket Fusion True Union (end connectors included)▯
3	PVDF
4	PP
5	PVC Sch 80 ▯ Solvent Socket
6	PVC Metric ▯ Solvent Socket

SIZE

	d	DN	≈ inches
1	20mm	15mm	1/2
2	25mm	20mm	3/4
3	32mm	25mm	1
4	40mm	32mm	1 1/4
5	50mm	40mm	1 1/2
6	63mm	50mm	2

*SYGEF® HP is the George Fischer High Purity PVDF formulation and process.

11. End Connectors Ordering Tree

3-7000.391- m s

MAT'L./CONFIG.

1	PVDF Metric, Butt Fusion▯
2	PVDF Metric, Fusion Sockets▯
3	PP Metric, Butt Fusion
4	PP Metric, Fusion Socket
5	PVC Sch 80
6	PVC Metric

SIZE

1	d20	1/2"
2	d25	3/4"
3	d32	1"
4	d40	1 1/4"
5	d50	1 1/2"
6	d63	2"

12. Sensor Assembly Part Numbers

Electrical	Materials/Configuration	Size (mm)	≈Size (in.)	Mfr. Part No.	Code
Frequency 3-7000	HP Union BCF/IR True Union (High Purity Polyvinylidene Fluoride Bead and Crevice Free / / Infra-Red welded) (shipped with white FPM O-rings)	d20	0.50	3-7000-11	159.000.106
		d25	0.75	3-7000-12	159.000.107
		d32	1.00	3-7000-13	159.000.108
		d40	1.25	3-7000-14	159.000.109
		d50	1.50	3-7000-15	159.000.110
		d63	2.00	3-7000-16	159.000.111
	HP PVDF Socket Fusion True Union (shipped with FPM O-rings)	d20	0.50	3-7000-21	159.000.112
		d25	0.75	3-7000-22	159.000.113
		d32	1.00	3-7000-23	159.000.114
		d40	1.25	3-7000-24	159.000.115
		d50	1.50	3-7000-25	159.000.116
		d63	2.00	3-7000-26	159.000.117
	PVDF (shipped with FPM O-rings)	d20	0.50	3-7000-31	159.000.118
		d25	0.75	3-7000-32	159.000.119
		d32	1.00	3-7000-33	159.000.120
		d40	1.25	3-7000-34	159.000.121
		d50	1.50	3-7000-35	159.000.122
		d63	2.00	3-7000-36	159.000.123
	Polypropylene (shipped with FPM O-rings)	d20	0.50	3-7000-41	159.000.124
		d25	0.75	3-7000-42	159.000.125
		d32	1.00	3-7000-43	159.000.126
		d40	1.25	3-7000-44	159.000.127
		d50	1.50	3-7000-45	159.000.128
		d63	2.00	3-7000-46	159.000.129
	PVC Sch 80 Solvent Socket (shipped with EPDM O-rings)	d20	0.50	3-7000-51	159.000.130
		d25	0.75	3-7000-52	159.000.131
		d32	1.00	3-7000-53	159.000.132
		d40	1.25	3-7000-54	159.000.133
		d50	1.50	3-7000-55	159.000.134
		d63	2.00	3-7000-56	159.000.135
	PVC Metric Solvent Socket (shipped with EPDM O-rings)	d20	0.50	3-7000-61	159.000.136
		d25	0.75	3-7000-62	159.000.137
		d32	1.00	3-7000-63	159.000.138
		d40	1.25	3-7000-64	159.000.139
		d50	1.50	3-7000-65	159.000.140
		d63	2.00	3-7000-66	159.000.141

12. Sensor Part Numbers (continued)

Electrical	Materials/Configuration	Size (mm)	≈Size (in.)	Mfr. Part No.	Code
Current 3-7001	HP Union BCF/IR True Union (High Purity Polyvinylidene Fluoride Bead and Crevice Free / / Infra-Red welded) (shipped with white FPM O-rings)	d20	0.50	3-7001-11	159.000.148
		d25	0.75	3-7001-12	159.000.149
		d32	1.00	3-7001-13	159.000.150
		d40	1.25	3-7001-14	159.000.151
		d50	1.50	3-7001-15	159.000.152
		d63	2.00	3-7001-16	159.000.153
	HP PVDF Socket Fusion True Union (shipped with FPM O-rings)	d20	0.50	3-7001-21	159.000.154
		d25	0.75	3-7001-22	159.000.155
		d32	1.00	3-7001-23	159.000.156
		d40	1.25	3-7001-24	159.000.157
		d50	1.50	3-7001-25	159.000.158
		d63	2.00	3-7001-26	159.000.159
	PVDF (shipped with FPM O-rings)	d20	0.50	3-7001-31	159.000.160
		d25	0.75	3-7001-32	159.000.161
		d32	1.00	3-7001-33	159.000.162
		d40	1.25	3-7001-34	159.000.163
		d50	1.50	3-7001-35	159.000.164
		d63	2.00	3-7001-36	159.000.165
	Polypropylene (shipped with FPM O-rings)	d20	0.50	3-7001-41	159.000.166
		d25	0.75	3-7001-42	159.000.167
		d32	1.00	3-7001-43	159.000.168
		d40	1.25	3-7001-44	159.000.169
		d50	1.50	3-7001-45	159.000.170
		d63	2.00	3-7001-46	159.000.171
	PVC Sch 80 Solvent Socket (shipped with EPDM O-rings)	d20	0.50	3-7001-51	159.000.172
		d25	0.75	3-7001-52	159.000.173
		d32	1.00	3-7001-53	159.000.174
		d40	1.25	3-7001-54	159.000.175
		d50	1.50	3-7001-55	159.000.176
		d63	2.00	3-7001-56	159.000.177
	PVC Metric Solvent Socket (shipped with EPDM O-rings)	d20	0.50	3-7001-61	159.000.178
		d25	0.75	3-7001-62	159.000.179
		d32	1.00	3-7001-63	159.000.180
		d40	1.25	3-7001-64	159.000.181
		d50	1.50	3-7001-65	159.000.182
		d63	2.00	3-7001-66	159.000.183

GF+ SIGNET

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+GF+ SIGNET 8550-1 Flow Transmitter

ENGLISH



3-8550.090-1



D-8/01 English



CAUTION!

- Remove power to unit before wiring input and output connections.
- Follow instructions carefully to avoid personal injury.

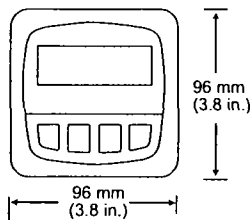
Contents

1. Specifications
2. Installation
3. Electrical Connections
4. Menu Functions



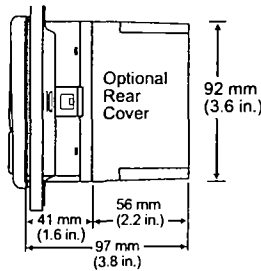
1. Specifications

Dimensions



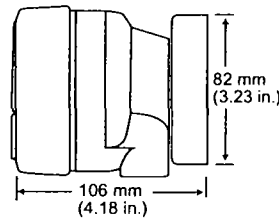
FRONT VIEW

Field Mount &
Panel Mount



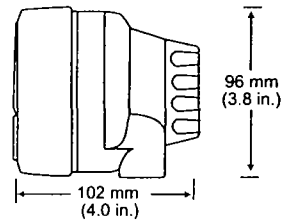
SIDE VIEW

Panel Mount



SIDE VIEW

Field Mount w/
8050 Universal base



SIDE VIEW

Field Mount w/
8051 Integral kit

General

Compatibility: +GF+ SIGNET Flow Sensors (w/freq out)

Enclosure:

- Rating: NEMA 4X/IP65 front
- Case: PBT
- Panel case gasket: Neoprene
- Window: Polyurethane coated polycarbonate
- Keypad: Sealed 4-key silicone rubber
- Weight: Approx. 325g (12 oz.)

Display:

- Alphanumeric 2 x 16 LCD
- Update rate: 1 second
- Contrast: User selected, 5 levels
- Display accuracy: $\pm 0.5\%$ of reading @ 25°C
- Thermal sensitivity shift: $\pm 0.005\%$ of reading per °C

Electrical

- Power: 12 to 24 VDC $\pm 10\%$, regulated, 61 mA max current

Sensor Input:

- Range: 0.5 to 1500 Hz
- Sensor power: 2-wire: 1.5 mA @ 5 VDC $\pm 1\%$
3 or 4 wire: 20 mA @ 5 VDC $\pm 1\%$
- Optically isolated from current loop
- Short circuit protected

Current output:

- 4 to 20 mA, isolated, fully adjustable and reversible
- Max loop impedance: 50 Ω max. @ 12 V
325 Ω max. @ 18 V
600 Ω max. @ 24V
- Update rate: 100 ms
- Accuracy: ± 0.03 mA

Open-collector output, optically isolated:

- 50 mA max. sink, 30 VDC maximum pull-up voltage.
- Programmable for:
 - High or Low setpoint with adjustable hysteresis
 - Pulse operation (max rate: 300 pulses/min).

Environmental

- Operating temperature: -10 to 70°C (14 to 158°F)
- Storage temperature: -15 to 80°C (5 to 176°F)
- Relative humidity: 0 to 95%, non-condensing
- Maximum altitude: 2000 m (6562 ft)
- Insulation category: II
- Pollution degree: 2

Standards and Approvals

- CSA, CE, UL listed
- Immunity: EN50082-2
- Emissions: EN55011
- Safety: EN61010
- Manufactured under ISO 9001 and ISO 14001

2. Installation

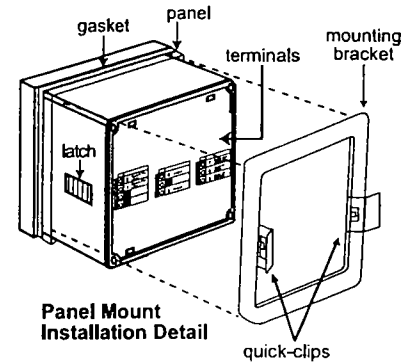
ProcessPro transmitters are available in two styles: panel mount and field mount. The panel mount is supplied with the necessary hardware to install the transmitter. This manual includes complete panel mounting instructions.

Field mounting requires one of two separate mounting kits. The 3-8051 integral kit joins the sensor and instrument together into a single package. The 3-8050 Universal kit enables the transmitter to be installed virtually anywhere.

Detailed instructions for integral mounting or other field installation options are included with the 3-8051 Integral kit or the 3-8050 Universal kit.

2.1 Panel Installation

1. The panel mount transmitter is designed for installation using a 1/4 DIN Punch. For manual panel cutout, an adhesive template is provided as an installation guide. Recommended clearance on all sides between instruments is 1 inch.
2. Place gasket on instrument, and install in panel.
3. Slide mounting bracket over back of instrument until quick-clips snap into latches on side of instrument.
4. To remove, secure instrument temporarily with tape from front or grip from rear of instrument. DO NOT RELEASE.



Press quick-clips outward and remove.

3. Electrical Connections



Caution: Failure to fully open terminal jaws before removing wire may permanently damage instrument.

Wiring Procedure

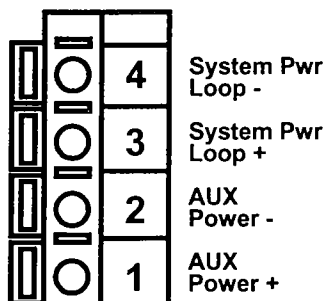
1. Remove 0.5 - 0.625 in. (13-16 mm) of insulation from wire end.
2. Press the orange terminal lever downward with a small screwdriver to open terminal jaws.
3. Insert exposed (non-insulated) wire end in terminal hole until it bottoms out.
4. Release orange terminal lever to secure wire in place. Gently pull on each wire to ensure a good connection.



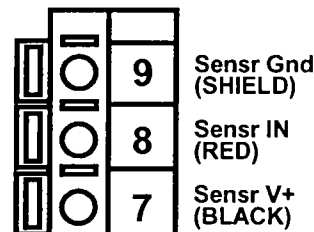
Wiring Removal Procedure

1. Press the orange terminal lever downward with a small screwdriver to open terminal jaws.
2. When fully open, remove wire from terminal.

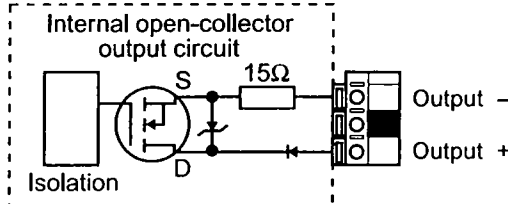
Terminals 3 and 4: Loop Power
12-24 VDC $\pm 10\%$ system power and current loop output.
Max. loop impedance:
50 Ω max. @ 12 V
325 Ω max. @ 18 V
600 Ω max. @ 24 V



Terminals 7-9: Flow sensor input



Terminals 1 and 2: AUXILIARY power
Used only if the flow sensor requires more than 1.5 mA current. For Signet sensors this is limited to the following products:
• 2000 • 2507
• 2530 • 2535
• 2540 if mfg. prior to Jan 1999



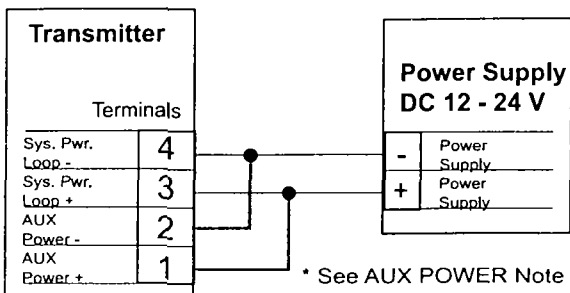
Terminals 5 and 6: Open-collector Output

A transistor output, programmable (see CALIBRATE menu) as:

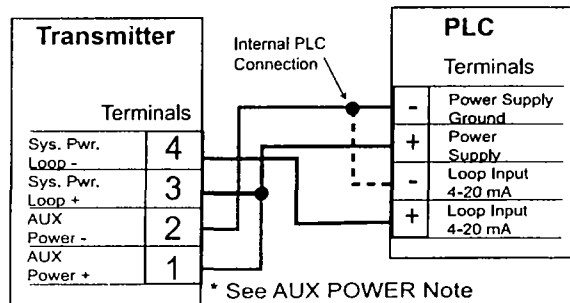
- High or Low setpoint with adjustable hysteresis
- Volumetric pulse
- Frequency based on flow rate
- May be disabled (Off) if not used.

3.1 System Power/Loop Connections

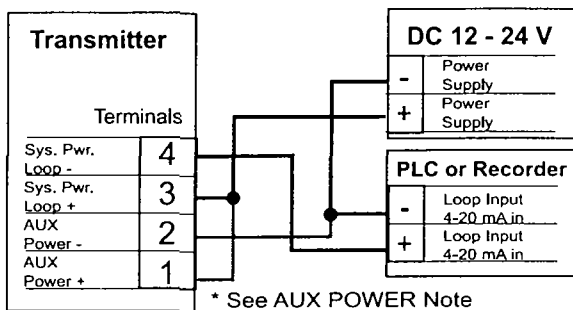
Stand-alone application, no current loop used



Connection to a PLC with built-in power supply



Connection to a PLC/Recorder, separate supply

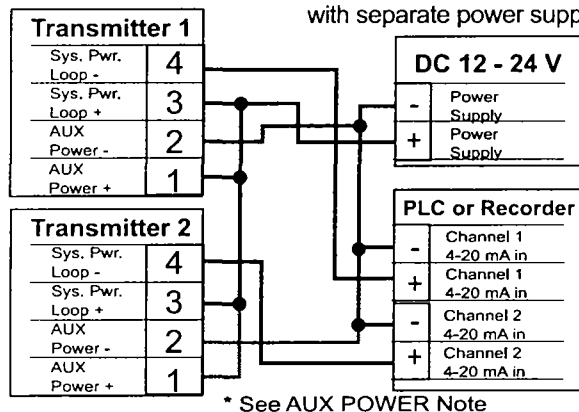


Auxiliary Power note:

AUXILIARY power is used only if the flow sensor requires more than 1.5 mA current. For Signet sensors this is limited to the following products:

- 2000 • 2507
- 2530 • 2535
- 2540 if mfg. prior to Jan 1999

Example: Two transmitters connected to PLC/Recorder with separate power supply

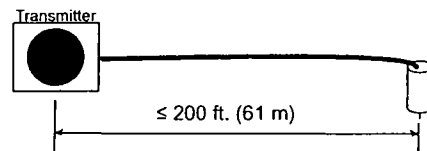


3.2 Sensor Input Connections

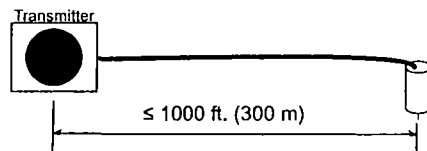
Wiring Tips:

- Do not route sensor cable in conduit containing AC power wiring. Electrical noise may interfere with sensor signal.
- Routing sensor cable in grounded metal conduit will help prevent electrical noise and mechanical damage.
- Seal cable entry points to prevent moisture damage.
- Only one wire should be inserted into a terminal. Splice double wires outside the terminal.

Maximum cable length is 200 ft. for 515/8510-XX, 525, 2517 and any sinusoidal flow signal.



Maximum cable length is 1000 ft. for 2536/8512-XX, 2540, vortex, and any square wave flow signal.



Terminals		No Aux Power	Aux Power
9	Sensr Gnd (SHIELD)	515	2000
8	Sensr IN (RED)	525	2507
7	Sensr V+ (BLACK)	2100	2530
		2517	2535
		2536	2540 (mfg prior to Jan 1999)
		2540	
		3-8510-XX	
		3-8512-XX	

3.3 Open Collector Output

The Open collector output can be used as a switch that responds when the flow rate moves above or below a setpoint, or it can be used to generate a pulse that is relative to the flow volume or to the flow rate.

• Low

Output triggers when the flow rate is less than the setpoint. The output will relax when the flow rate moves above the setpoint plus the hysteresis value.

• High

Output triggers when the flow rate is greater than the setpoint. The output will relax when the flow rate drops below the setpoint plus the hysteresis value.

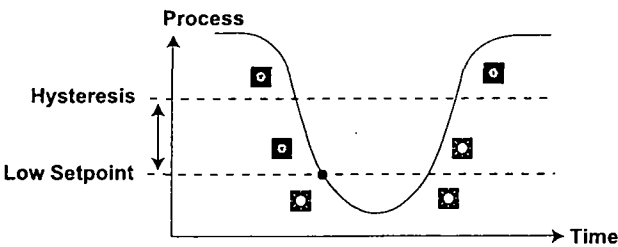
• Frequency



Output is a pulse stream that is based on the input flow sensor signal. Set for 1 (input frequency = output frequency). Set for even numbers (2, 4, 6, 8 254 maximum) to scale output frequency.

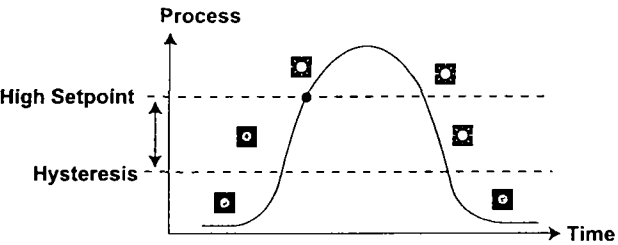
• Pulse

Output is a pulse based on the volume of fluid that passes the sensor. Set any value from 0.0001 to 99999.

The output may be disabled (Off) if not used.



Relay energized 
Relay relaxed 



VIEW menu

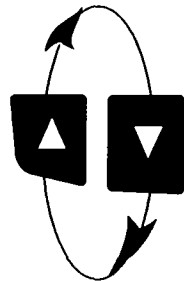
- During normal operation, the ProcessPro displays the VIEW menu.
- When using the CALIBRATE or OPTIONS menus, the ProcessPro will return to the VIEW menu if no activity occurs for 10 minutes.
- To select the item you want displayed, press the UP or DOWN arrow keys. The items will scroll in a continuous loop. Changing the display selection does not interrupt system operations.
- No key code is necessary to change display selection.
- Output settings cannot be edited from the VIEW menu.



View Menu

Display	Description
0.0 GPM Total: 12345678 >	Monitor the flow rate and the resettable totalizer. Press the RIGHT ARROW key to reset the totalizer. If the Reset is locked, you will need to enter the Key Code first. Lock or Unlock the totalizer in the OPTIONS menu. This is the permanent View display.
Perm: 12345678 Gallons	Monitor the Permanent Totalizer value.
Loop Output: 12.00 mA	Monitor the 4-20 mA Loop output.
Last CAL: 06-30-01	Monitor date for scheduled maintenance or date of last calibration. (See description in Calibrate Menu.)

All of the displays below are temporary. After ten minutes the display will return to the permanent display.



ProcessPro Editing Procedure:

Step 1. Press and hold ENTER key:

- 2 seconds to select the CALIBRATE menu
- 5 seconds to select the OPTIONS menu.

Step 2. The Key Code is UP-UP-UP-DOWN keys in sequence.

- After entering the Key Code, the display will show the first item in the selected menu.

Step 3. Scroll menu with UP or DOWN arrow keys.

Step 4. Press RIGHT ARROW key to select menu item to be edited.

- The first display element will begin flashing.

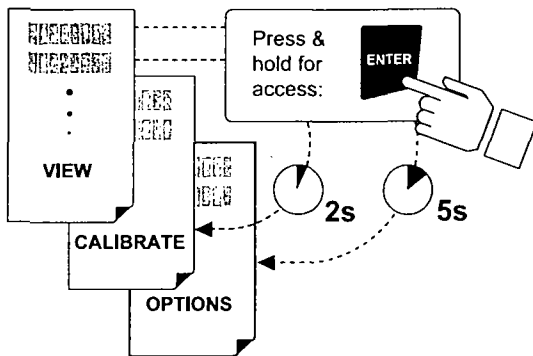
Step 5. Press UP or DOWN keys to edit the flashing element.

- RIGHT ARROW key advances the flashing element.

Step 6. Press ENTER key to save the new setting and return to Step 3.

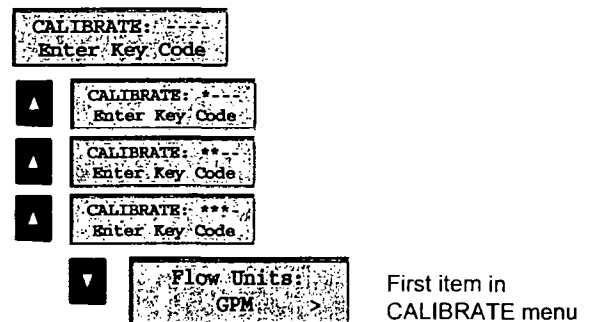
Notes on Step 1:

- The View Menu is normally displayed.
- The CALIBRATE and OPTIONS menus require a KEY CODE.



Notes on Step 2:

If no key is pressed for 5 minutes while display is showing "Enter Key Code", the display will return to the VIEW menu.



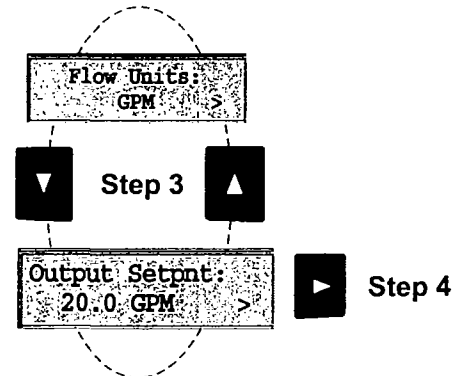
Notes on Steps 3 and 4:

- Refer to pages 6 and 7 for complete listing of menu items and their use.
- From the Step 3 display, pressing the UP and DOWN keys simultaneously will return the display to the VIEW menu.
- If no key is pressed for 10 minutes, display will also return to the VIEW menu.



Step 3: Finished Editing?

Press the UP and DOWN keys simultaneously after saving the last setting to return to normal operation.

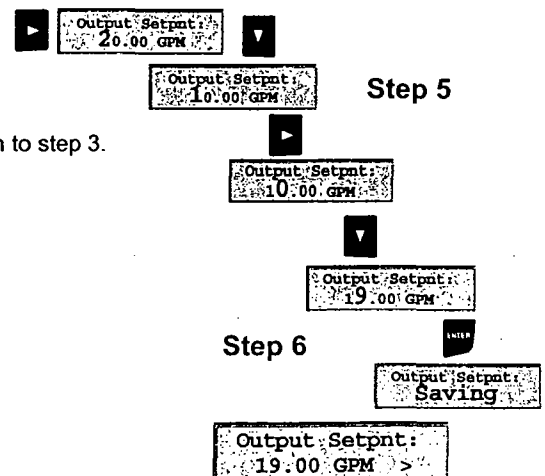


Notes on Steps 5 and 6:

- All output functions remain active during editing.
- Only the flashing element can be edited.
- RIGHT ARROW key advances the flashing element in a continuous loop.
- Edited value is effective immediately after pressing ENTER key.
- If no key is pressed for 10 minutes unit will restore the last saved value and return to step 3.
- Step 6 (pressing ENTER key) always returns you to Step 3.
- Repeat steps 3-6 until all editing is completed.

Step 5: Made an Error?

Press the UP and DOWN keys simultaneously while any element is flashing. This will recall the last saved value of the item being edited and return you to Step 3.



Calibrate Menu

Display (Factory settings shown)	Description
Flow Units: GPM >	The first three characters set the Flow Rate units of measure. They have no effect on calculations. They may be any alpha or numeric character, upper or lower case. The last character sets the Flow rate Timebase. Select S (seconds), M (minutes), H (hours) or D (days).
Flow K-Factor: 60 >	This setting tells the transmitter how to convert the input frequency from the flow sensor into a flow rate. The K-factor is unique to the sensor model and to the pipe size and schedule. Refer to data in the sensor manual for the correct value. Limits: 0.0001 to 99999. (The K-factor cannot be set to 0)
Total Units: Gallons >	This setting identifies the Totalizer units. It has no effect on any calculation. It serves as a label only. Each character can be any alpha or numeric selection, upper or lower case.
Total K-Factor 60 >	This setting tells the transmitter how to convert the input frequency from the flow sensor into a volumetric total. It also is used as the basis for the Open Collector pulse mode. The setting is usually the same as the Flow K-factor, or different by x10 or x100. Limits: 0.0001 to 99999. (The K-factor cannot be set to 0)
Loop Range: GPM 000.00 → 100.00 >	Select the minimum and maximum values for the 4-20 mA Current loop output. The 8550 will allow any values from 0.0000 to 99999.
Output Mode: Low >	Select the desired mode of operation for the Open Collector output. Options available are High, Low, volumetric Pulse, or Frequency. The signal may be disabled (Off) if not used.
Output Setpnt: 10.0 GPM >	In Low or High Mode, the Open Collector output will be activated when the Flow rate reaches this value. Be sure to modify this setting if you change the Flow Units.
Output Hys: 5.0 GPM >	The Open Collector output will be deactivated at Setpoint ± Hysteresis, depending on High or Low Setpoint selection. (See details on page 4.)
Output Volume: 100.00 Gallons >	In Pulse mode, the Open collector output will generate one pulse when this volume of flow passes the sensor. The measurement is based on the Total K-factor. The 8550 will allow any value from 0.0001 to 99999.
Output PlsWdth: 0.1 Seconds >	In Pulse mode, this setting defines the duration of the Open Collector output pulse. The 8550 allows any value from 0.1 seconds to 999.9 seconds.
Output Freq.: Divide by 1 >	In Frequency mode, the Open Collector output will simulate the sensor frequency, divided by this setting. Set for 1 (input frequency = output frequency). Set for even numbers (2, 4, 6, 8 . . . 254 maximum) to scale output frequency.
Last CAL: 6-30-01	Use this "note pad" to record important dates, such as annual recertification or scheduled maintenance.

Options Menu

Display (Factory settings shown)	Description
Contrast: 3 >	Adjust the LCD contrast for best viewing. A setting of 1 is lower contrast, 5 is higher. Select lower contrast if the display is in warmer ambient surroundings.
Flow Decimal ***** >	Set the decimal to the best resolution for your application. The display will automatically scale up to this restriction. Select *****., *****, ***., **, * or .*****
Total Decimal *****.** >	Set the totalizer decimal to the best resolution for your application. Select *****., *****., or *****.
Averaging: Off >	.OFF provides the quickest output response to changes in flow. LOW averaging = 4 seconds, HIGH averaging = 8 seconds of input signal. Longer averaging produces more stable display and output response.
Total Reset: Lock Off >	Lock Off : No key code required to reset the resettable totalizer. Lock On : The Key Code must be entered to reset the resettable totalizer.
Loop Adjust: 4.00 mA >	Adjust the minimum and maximum current output. The display value represents the precise current output. Adjustment limits: • 3.80 mA < 4.00 mA > 5.00 mA • 19.00 mA < 20.00 mA > 21.00 mA Use this setting to match the system output to any external device.
Loop Adjust: 20.00 mA >	
Output Active: Low >	Active HIGH: This setting is used to turn a device (pump, valve) ON at the setpoint. Active LOW: This setting is used to turn a device OFF at the setpoint.
Test Loop: >	Press UP or DOWN keys to manually order any output current value from 3.6 mA to 21.00 mA to test current loop output.
Test Output: >	Press UP or DOWN keys to manually toggle the state of open collector output.

Troubleshooting

Display Condition	Possible Causes	Suggested Solutions
"- - - -"	Flow rate exceeds display capability	<ul style="list-style-type: none"> • Increase Flow units time base • Move flow decimal one place to the right
"Pulse Overrun"	<ul style="list-style-type: none"> • Open Collector pulse rate exceeds maximum of 300 pulses per minute. • Pulse width set too wide. 	<ul style="list-style-type: none"> • Increase Pulse volume setting • Decrease pulse width setting. • Reduce system flow rate
"Value must be more than 0"	K-factors cannot be set to 0.	Enter K-factor from 0.0001 to 99999
Open Collector is always activated	<ul style="list-style-type: none"> • Hysteresis value too large • Defective transmitter 	<ul style="list-style-type: none"> • Change the hysteresis value • Replace transmitter

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OIL / WATER
SEPARATOR

HYDRO QUIP, INC.

Water Treatment Equipment

**OIL WATER SEPARATOR
OPERATION AND
MAINTENANCE MANUAL**

for

Model AG-5SS-300V-HP

PURCHASE ORDER # 20169

Product Level Control

Burnsville, MN 55337

HYDRO QUIP INC.

Water Treatment Equipment

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- 8.0) MAINTENANCE PROCEDURES
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- 10.0) MECHANICAL INFORMATION
 - a) OWS GENERAL ARRANGEMENT DRAWING
 - b) OWS INSTALLATION DRAWING
- 11.0) WARRANTY

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Water Treatment Equipment

1.0 INTRODUCTION

Hydro Quip, Inc. (HQI) Oil Water Separator (OWS) Model AG-5SS-300V-HP will remove essentially all free and dispersed, non emulsified oil, and settleable solids from the oil water mixture at a flow rate of 100 GPM at a temperature of 55 degrees F. The design utilizes the difference in specific gravity between oil and water (buoyancy force) enhanced by the use of 40 cubic feet of UNIPACK coalescing plates. The separator is designed to receive oily water by gravity/pumped flow that will not mechanically emulsify the oil and will process it on a once through basis. The tank will be a single wall, rectangular unit installed above grade. It will be constructed of stainless steel. The UNIPACK coalescing plates are manufactured of UV-Resistant PVC material.

2.0 SYSTEM DESCRIPTION AND REQUIREMENTS

2.1 FABRICATION: The oil water separator is a special purpose prefabricated parallel corrugated plate, rectangular, gravity displacement, type oil water separator. The separator shall be comprised of a tank containing an inlet compartment, separation chamber, sludge chamber, and clean water outlet chamber.

2.2 TANK: The tank shall be a single wall construction 11 gauge stainless steel conforming to ASTM A240 . Welding will be in accordance with AWS D1.1 to provide a watertight tank that will not warp or deform under load. Pipe connections to the exterior shall be as follows:

2.2.1 PIPE CONNECTIONS: All connections 3" and smaller are FNPT couplings. All connections 4" and larger are flat face flanges with ANSI 150 pound standard bolt circle. Use flanged piping connections that conform to ANSI B16.5.

2.3 SEPARATOR CORROSION PROTECTION: (For Carbon Steel Only) After shop hydrostatic test has been successfully completed, a coating system will be applied to the interior and exterior surfaces of the separator. Interior and exterior shall be sandblasted to SSPC-SP10; Interior lined with Tnemec Series 61 liner to 9 mils MDFT; Exterior coated with polyamide epoxy to 6 mils MDFT.

2.4 LIFTING LUGS: The tank shall be provided with properly sized lifting lugs for handling and installation.

2.5 COVERS: The tank will be provided with a vapor tight covers for vapor control. Gas vents and suitable access openings to each compartment will be provided. The covers shall be constructed of the same material as the

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tank and will be fastened in place. A gasket shall be provided for vapor tightness. 304 SS Bolts will be provided for cover attachment.

2.6 INLET COMPARTMENT: The inlet chamber shall be comprised of a non-clog diffuser to distribute the flow across the width of the separation chamber. The inlet compartment shall be of sufficient volume to effectively reduce influent suspended solids, dissipate energy and begin separation. The media will sit elevated on top of a sludge baffle. The sludge baffle will be provided to retain settleable solids and sediment from entering the separation chamber.

2.7 SEPARATION CHAMBER: The oil separation chamber shall contain HQI UNIIPACK parallel corrugated plates. The plates shall be at a 60 degree angle with respect to longitudinal axis of the plate corrugations and spaced 1/2" apart for removal of free oil 60 micron in size or greater and settleable solids. Configuration does not promote solids buildup on the plates, which would increase velocities to the point of discharging an effluent of unacceptable quality. Laminar flow with a Reynolds Number of less than 500 at a maximum design flow rate shall be maintained throughout the plate packs including entrance and exit so as to prevent re-entrainment of oils) with water. Flow through the plate packs shall be crossflow perpendicular to plate corrugations so that the oil collects and coalesces at high points of corrugations and rises to the top of pack without clogging due to oil or settleable solids.

2.8 BAFFLES: An oil retention & underflow weir, and overflow weir. Position underflow weir to prevent resuspension of settled solids.

2.9 SLUDGE CHAMBER: The sludge chamber shall be located prior to the coalescing compartment for the settling of any solids. It shall also prevent any solids from entering the clean water chamber.

2.10 OIL SKIMMER : The oil separation chamber will be provided with a rotatable pipe skimmer for gravity decanting of the separated oil to a product storage tank.

2.11 CLEAN WATER CHAMBER: The tank will be provided with a 300 gallon clean water chamber which allows the water to leave the separator by pumped flow through the clean water outlet port.

2.12 VENTS: 1" vents will be provide with vent piping to atmosphere.

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3.0 SAFETY AND ENVIRONMENTAL CONSIDERATIONS

3.1 All normal safety precautions should be taken with this equipment to prevent accidents and fires.

3.2 Normal fire prevention measures must be taken to prevent fire danger from separated oil.

3.3 Care should be taken to keep the area around the separator clean to prevent accidents.

3.4 Disposal of the separated oil and solids, which may contain hazardous material, must comply with the regulations of the authority having jurisdiction.

3.5 Safety and environmental protection are the responsibility of the user. HQI assumes no liability for misuse of this separator or for use outside the purpose for which it is designed.

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4.0 INSPECTION AND OFFLOADING

4.1 INSPECTION: Inspect the oil water separator upon delivery for any damage which may have occurred in shipment. Areas most susceptible to damage are connections and cover openings. If the separator is damaged, HQI should be notified immediately. The off loading personnel should note the extent of damage and sign and date the bill of lading. A claim should be filed with the delivering carrier.

4.2 OFF LOADING: The separator must be carefully removed from the truck so the unit is not damaged. Components for the separator are often supplied in a separate carton. Proper rigging practices should be observed at all times. Hoisting equipment operators should attach a guide line to prevent the separator from swinging out of control. Do not drop the separator or allow it to fall hard in the process of inverting, turning, or moving. Do not slide the separator.

4.3 COATINGS: All damaged coatings should be touched up immediately ! Please contact the factory if more specific information is required. Under no conditions should chains or cables be put around the separator. Use spreader bars, and the lifting eyes on the unit.

4.4 STORAGE: If the equipment is not to be installed at the time of delivery, it should be stored in an area away from traffic. The ground should be level and free sharp objects that might damage the coatings. All equipment should be stored off the ground on timbers. All factory packing should remain intact until the unit is ready for installation. Equipment should be stored indoors. If not, care should be taken that tanks do not fill up with water and debris. Covering all of the equipment with a tarp is strongly recommended.

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5.0 SYSTEM INSTALLATION

When placing the separator for system operation, be sure it is installed on a concrete foundation which provides adequate support under full load operating conditions. Even if a mounting skid is used, a concrete pad or other properly designed structure must be installed as a foundation. The length and width of this pad are dependent upon the footprint of the unit. Thickness of the concrete pad depends on local soil and frost conditions. A local qualified civil engineer should be contacted to determine these dimensions.

5.1 FOR EQUIPMENT SUBJECT TO TRAFFIC LOADS

1. A concrete slab must be installed around the equipment if the separator is going to be subject to traffic loads. It should be designed to carry the load and transmit the load into adjacent, undisturbed soil, not onto the tank side walls!
2. If a concrete pad is not installed and the equipment is subject to traffic loads, deformation or in some cases total collapse of the equipment may occur. HQI cannot be held responsible for equipment subjected to such loads!

5.2 LEVELING

1. At this point the equipment should be set exactly in place and the anchor bolts should be installed.
2. Remove any lids.
3. The tankage should now be made as level as possible. The absolute minimum requirements being, within $\pm 1/16$ " per foot from inlet to outlet end of tank and $\pm 1/16$ " per foot from side to side, maximum of $\pm 1/4$ " total. Shim the tank, if necessary, until these parameters are met. We recommend the use of stainless steel shim stock. When installing shims, make sure to locate them under all vertical tank supports.

NOTE: We cannot stress enough the leveling process. It is better to invest a little time at this point than to try to correct an improperly leveled tank later. A level installation functions better, has a better appearance and will give you fewer problems in the future.

The next step toward system start involves the plumbing and electrical connections. Any valves and/or piping should be adequately supported and accepted piping and valve practices must be followed for proper system

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operation. Any pump or level probe wiring and conduit connections should be made at this time. If the unit includes internal level detection, insert the level detection probe into the port indicated on the drawing. Be sure to lower the probe to the correct level indicated on the drawing.

PLUMBING

1. When making connections to the equipment do not use the equipment as a pipe support. All plumbing should stand on its own if disconnected from equipment. HQI cannot be held responsible for damage caused by using this equipment to support your plumbing.
2. Connections do not have to be made in the order listed below. Review your situation and make the connections in the most convenient order for your particular application.
3. Connect the outlet plumbing. The effluent plumbing must be the same size or larger than the nozzle size of the equipment. Do not reduce the size of the effluent piping as this might cause hydraulic overloading of the equipment. Also, try to run the discharge piping through as few changes as possible, as short a distance as possible and at a pitch of not less than 1/16" per foot. On gravity flow units it may be necessary to vent exterior piping to prevent air locks in discharge pipe.
4. Connect the inlet plumbing. The influent must be the same size or smaller than the nozzle size on the equipment. Do not increase the size of the influent piping as this might cause hydraulic overloading of the equipment. Also, the pitch of the pipe should not exceed 1/16" per foot.
5. On most units, vents will have been provided. These vents have been supplied to prevent air locks during surge conditions. For both indoor and outdoor applications the vents should be run to a location where noxious and sometimes volatile gas would pose no hazard. Follow all applicable fire codes with regards to size of vent pipe.

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6.0 SEPARATOR SET UP AND START UP PROCEDURES

6.1 SEPARATOR SET UP PROCEDURES:

The inlet flow to the separator must be by gravity or a positive displacement pump upstream. Centrifugal pumps greatly agitate the oil and water and tend to make a stable emulsion that is very difficult, if not impossible, to separate by gravity settling.

Separator flow should be controlled upstream to ensure even, steady flow, and stable conditions in the separator. Unstable flows tend to reduce efficiency and may cause high oil concentration at the outlet.

6.1.1 The separator tank is atmospheric in design and must be vented to the atmosphere. Consult the OWS drawing for location of all vents.

6.1.2 To achieve the desired flow, excessive throttling of the input must be avoided as this will also cause emulsification of the oil, adversely affecting separator performance. Especially avoid the use of globe type or other valves with high pressure drops.

6.1.3 It is recommended that the effluent water flows by gravity flow from the separator. The pressure loss for the water effluent pipe shall not exceed the drop elevation of the customer lines. External piping should be separately supported. The separator is not designed to support piping.

6.1.4 To install the separator, follow these steps:
(Please refer to attached installation drawing)

1. Ensure that the source of the water to be treated is properly regulated and not provided with a centrifugal pump or other device which will cause emulsification such as a high pressure drop valve.
2. Ensure that the separator is securely installed per installation drawing.

6.2 SEPARATOR START-UP PROCEDURES:

6.2.1 Initial start-up.

This procedure is to be followed after the installation of the separator or after the separator has been drained for maintenance and is ready to be restarted.

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1. Ensure that the owner supplied upstream influent flow regulating valve is closed.
2. Before starting the flow to the unit, remove the coalescer access cover and ensure that the UNIPACK packs have not shifted and are securely fastened. The separator should contain plate packs, polishing pack and adjustable oil skimmer pipe tube. (Slot of skimmer to be turned upward away from water)
3. Ensure that there are not obstructions in the water outlet piping.
4. With the coalescer access cover off, fill the tank with clean water, establishing flow from the effluent opening. Check for leaks, both external and internal remedy any found.
5. Allow the influent oil water mixture into the OWS tank.
6. Replace the coalescer access cover and bolt down liquid tight.

6.2.2 Normal operation:

Carefully maintain flow at the rate set when flow was established. Once a sufficient quantity of oil has accumulated in the separator, turn the slot of the skimmer into the oil layer (The oil will then be decanted into an integral oil storage compartment or to a separate tank outside of the separator). Disposal of the oil must comply with regulations of the authority having jurisdiction.

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Water Treatment Equipment

7.0 QUALITY ASSURANCE

7.1 INSPECTION: Examine each component of the separator for compliance with requirements indicated in Section 2 - System Description & Requirements. This element of inspection shall encompass visual examination.

7.2 PRETEST PROCEDURES: After separator has been leveled, hydrostatically test unit for (4) hours by filling full with potable water, provided by customer, with means of getting it from the nearest source by the installer. Acceptance criteria for this test is no leakage after four (4) hours.

7.3 TESTS: - After hydrostatic test has been successfully completed and unit has been properly connected to influent and effluent piping, allow influent oil water mixture of 100 ppm, to flow into separator filled with potable water. After injection, operate unit for a minimum of ten tank volume changes prior to testing for contaminant removal.

7.4 TEST FOR CONTAMINANTS: The installer shall test the effluent to ensure that it meets oil concentration levels described in Section 2 - System Description & Requirements. Test shall be performed by an independent certified testing laboratory.

7.5 ANALYTICAL METHODS: Test and sample preservation methods for test contaminants shall be in accordance with the latest revision of EPA Methods for Chemical Analysis of Water and Wastes. Effluent oil concentration shall be measured by gravimetric, Separatory Funnel Extraction Method API 413.1.

HYDRO QUIP INC.

Water Treatment Equipment

8.0 MAINTENANCE

8.1 The separator should be checked periodically to determine if excessive amounts of solids and debris have accumulated. If this happens the solids may accumulate enough to plug the lower part of the UNIPACK plates. In this case, efficiency will be reduced and oil in the outlet water may exceed specified effluent limits.

8.2 After the first 6 months of operation, the inlet area should be inspected and cleaned as follows:

1. Stop the flow of influent to the separator.
2. Remove separator cover.
3. Dispose of separated oil per regulatory procedures.
4. Remove water from separator through drain or hose.

8.3 Measure and record the depth of the solids. Use this measurement as the timing basis for the next solids inspection and clean out. Consult OWS drawing for depth of sludge baffle. Solids should not exceed this depth.

8.4 The UNIPACK plate packs can be either cleaned in place or removed and cleaned.

1. For cleaning in place, connect a pressure water hose (1-15 psig) and insert in plate spacing on top of the plate packs. As the water flushes the dirt out of the plate packs it should be removed by the vacuum hose.

2. For removing plate packs outside of separator. Flush with garden hose (10-15 psig) over an area to prevent discharge of flushed water into groundwater. It is only necessary to remove all sludge from between the plates and any very heavy oil coating.

8.5 Examine tank interior for damage and repair any damage to internal coating.

8.6 To restart separator, reinstall UNIPACK plate packs and polishing pack in original position. Make sure that both are securely in place so that they do not float when unit is operational.

8.7 For start up, repeat steps in section 6 of these instructions.

HYDRO QUIP INC.

Water Treatment Equipment

9.0 TROUBLESHOOTING

Regularly monitor the quality of the effluent leaving the separator. If any loss in effluent quality is observed, steps should be taken to correct the problem immediately. Some things to check if effluent quality has deteriorated are:

1. Have you exceeded the separators rated flow ? If so, return the flow rate to the design flow rate.
2. Have you allowed the sludge to accumulate to a point where it has started to effect the performance of the separator? If so, take steps to have the sludge removed immediately. If it cannot be pumped out, you will have to drain the separator and remove the accumulated sludge.
3. Check the influent for surfactants or chemical emulsifiers. If any are present, you may need additional treatment in order to meet discharge requirements.
4. Are you pumping into the separator ? If so, you may be mechanically emulsifying the influent oil. Sample the oil water from both before and after the pump. There should be no differences between the two samples. If you are mechanically emulsifying the oil you may have to change your influent pump to a low RPM positive displacement pump or similar pump that will cut down on shearing.
5. Check to make sure that the oil depth in the separator is not too great, a deep layer of product will recuce the efficiency of the separator. Free product should be removed and the separator put back in service.

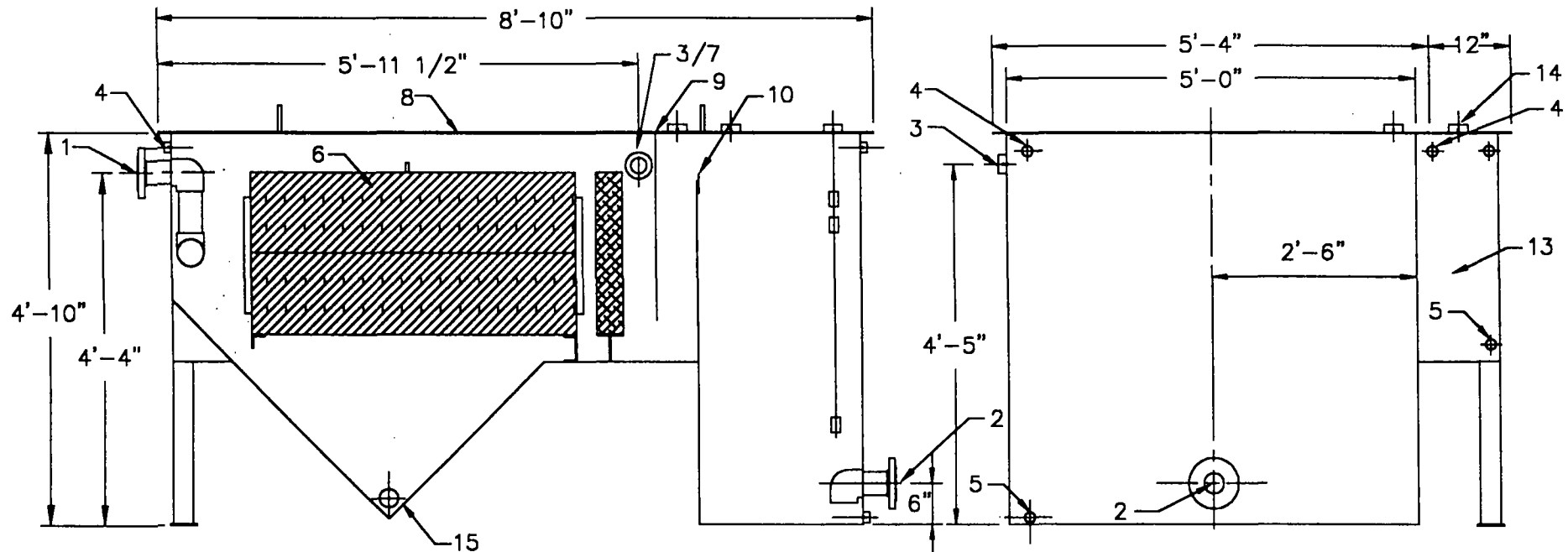
9.1 TROUBLESHOOTING GUIDELINE

PROBLEME	POSSIBLE CAUSE	DIAGNOSTIC TECHNIQUE	CORRECTIVE ACTION
EFFLUENT CONCENTRATION TOO HIGH	Oil Concentration too Great for Design	Sample Influent	Decrease the Flow Rate
	Flow Too Great For Design	Check Flow	Decrease The Flow Rate
	Plates Blocked	Inspect, Remove Plates if Necessary	Clean Per Par. 8.4 Instructions and Reinstall
	Solids have Accumulated Into Coalescer Plates	Check Depth of Solids In Coalescer Compartment	Remove Solids From Compartment See Par. 8.3
TANK IS OVERFLOWING	Output Line Restricted	Check Flow	Remove Restriction

Note: For proper operation, outlet line should be as large as outlet nozzle unless unit is to be operated at very large flows

ITEM	QTY	DESCRIPTION	ITEM	QTY	DESCRIPTION
1	1	3"-150# RF FLG. INLET	9	1	OIL STOP WEIR
2	1	3"-150# RF FLG. OUTLET	10	1	ADJ. OVERFLOW WEIR
3	1	2" FNPT OIL OUTLET	11	0	OPTIONAL MESH PAD
4	3	1" FNPT VENT	12	0	OPT. SIGHT GLASS PORTS
5	3	1" FNPT DRAIN	13	1	OPTIONAL PRODUCT TANK
6	1	COALESCING PLATES	14	3	2" BULKHEAD IN COVER
7	1	PVC OIL SKIMMER	15	2	2" FNPT SLUDGE DRAIN
8	1	REMOVABLE COVER	16	1	2" FNPT FLOAT SWITCH

SHIPPING WEIGHT	1150 LBS
OPERATING WEIGHT	9251 LBS
SEPARATOR VOLUME	1264 GALLONS
EFFLUENT TANK VOLUME	300 GALLONS
SLUDGE VOLUME	150 GALLONS
COALESCING AREA	40 FT ²
OPT. PRODUCT TANK VOL	140 GALLONS



ELEVATION

RIGHT SIDE VIEW

NOTES

1. MATERIAL: 11 GAUGE 304SS.
2. GASKET: NEOPRENE.
3. HARDWARE: 18-8 STAINLESS STEEL
4. INTERNAL PIPE SCH 40 PVC

REV.	DESCRIPTION	DATE	INIT.
HYDRO QUIP. INC.			
Water Treatment Systems			
GENERAL ARRANGEMENT		DRN. BY: PMD	
MODEL AG5SS-300V-HP		CHKD. BY:	
PROJECT:		DATE: 11/12/02	
REF:	FILE: AG5SSVHP1H	SCALE: 1/4" = 1'	
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NOTES

COVER GASKET: NEOPRENE
GASKET: NEOPRENE.
HARDWARE: 18-8 STAINLESS STEEL
SKIMMER SCHEDULE 80 PIPE
CONNECTION ARE NPT FITTINGS
ANCHOR BOLT TO BE 3/8" DIA. MIN. WITH
4" INBEDMENT & 2" PROJECTION

REV.	DESCRIPTION	DATE	INT.
<p style="text-align: center;">HYDRO QUIP. INC.</p> <p style="text-align: center;">Water Treatment Systems</p>			
OIL/WATER SEPARATOR MODEL AG-SS-VH		DRN. BY: PMD	
PROJECT:		CHK'D BY:	
REF:	FILE: AGSWHP	DATE: 3/8/01	
THIS DRAWING IS PROPERTY OF HYDRO QUIP INC. AND MUST NOT BE REPRODUCED OR DISTRIBUTED WITHOUT WRITTEN PERMISSION.		SCALE: NONE	
		REV: 0	

HYDRO QUIP INC.

Water Treatment Systems

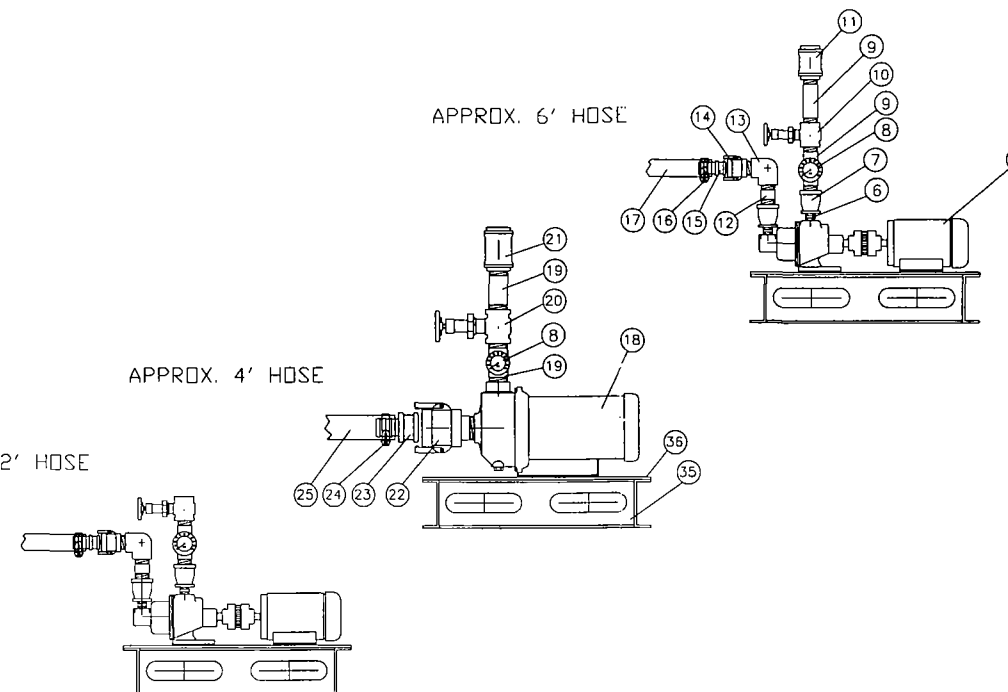
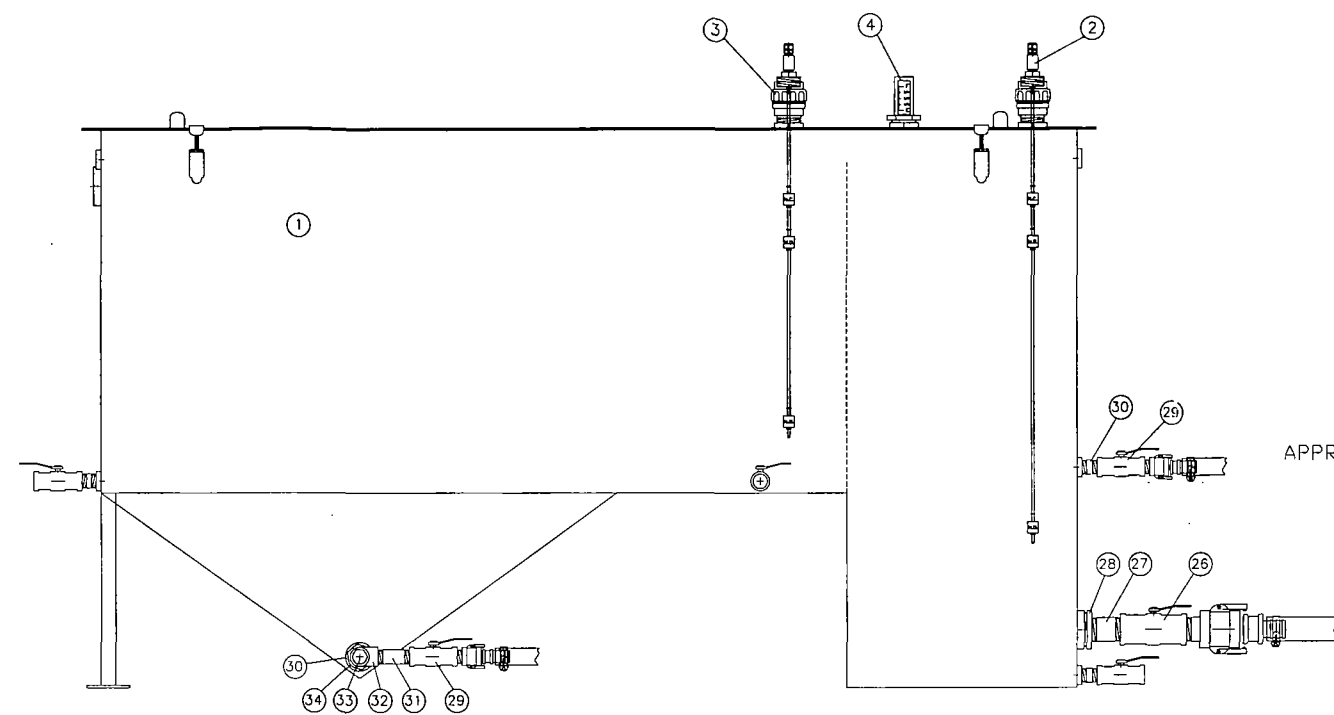
LIMITED WARRANTY

Hydro Quip's equipment is warranted as to workmanship, material, and performance when properly installed, used, and cared for, and provided that the original design criteria represent actual field data at the time of operation. Should any part or parts prove defective within twelve (12) months from date of purchase, it will be replaced F.O.B. destination without charge, provided the part (or parts) is returned transportation charges prepaid.

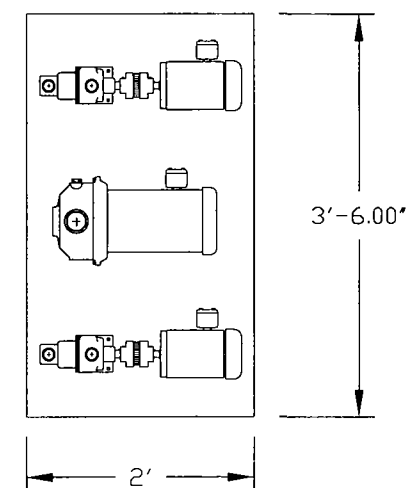
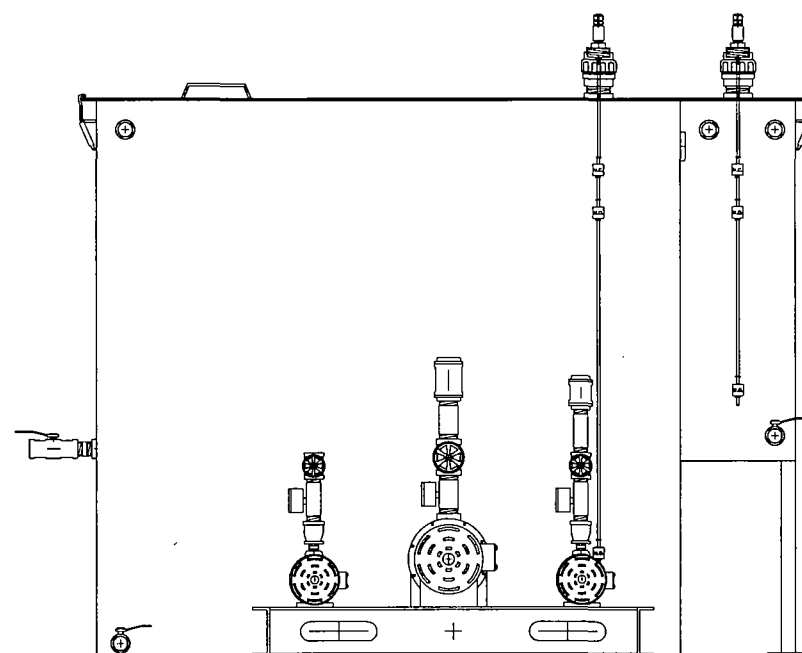
No allowance will be made for labor, transportation, or other charges incurred in the replacement or repair of defective parts by the customer. This warranty does not apply when damage is caused by conditions such as sand or abrasive materials pumped with the fluids, lightning, improper voltage supply, careless handling, improper installation, stray electrical interference, or due to substances or factors that were unknown to Hydro Quip at the time of purchase. Buyer shall have no claim, and no product or part shall be deemed defective, by reason of failure to resist erosive or corrosive action, nor for problems resulting from buildup of material within the equipment.

This warranty applies only to seller's equipment, under use and service in accordance with the seller's written instructions, recommendations and ratings for installation, operating and maintenance, and service. All claims for defective products, parts, or work under this warranty must be made in writing immediately upon discovery and, in any event, within one year of purchase.

This warranty is a *Limited Warranty*; anything in the warranty notwithstanding. Implied warranties for particular purpose and merchantability shall be limited to the duration of the express warranty. The manufacturer expressly disclaims and excludes any liability of consequential or incidental damages for breach of any express or implied warranty.



NOTE: BOTH MOYNO PUMPS HAVE THE SAME BASIC PIPING



0 3 6 9 12 15 18 21 24
SCALE
IN INCHES



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BURNSVILLE, MN. 55337
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Fax: 952-707-1075

TOLERANCES ± .250"
DRAW. NUMB. 02-072 AG-5SS-300V-HP-1P OWS SKID MOUNTED

CLIENT	ENVIRONMENTAL QUALITY MANAGEMENT	DATE	10/10/02
SITE	GARY AIRPORT	BY	SCOTT PETERSON SYSTEMS ENGINEER
TITLE-1	OIL WATER SEPARATOR @ UP TO 100 GPM	PAGE	01 OF 02
TITLE-2	EQUIPMENT VIEW	SCALE	AS SHOWN
REVISION	01 BY 0	DATE	0
REVISION	02 BY 0	DATE	0
REVISION	03 BY 0	DATE	0

	DESCRIPTION	PART NUMBER	QTY	VENDOR	PURCHASE ORDER	DATE ORDERED	COST	MOUNTED/LOOSE	
1	100 GPM STAINLESS STEEL OWS UNIT	AG-5SS-300V-HP-1P	1	HYDRO-QUIP	0	0	0	0	1
2	PLC TRI-LEVEL SENSOR w/ 25' LEAD	PLC 550-270	2	PLC	0	0	0	0	2
3	2" PVC SENSOR ADAPTER	PLC 550-278	2	PLC	0	0	0	0	3
4	OIL TANK LEVEL MANUAL LEVEL INDICATOR	3711K2	1	McMASTER CARR	0	0	0	0	4
5	MOYNO PROGRESSIVE CAVITY PUMP 3/4-HP 230V 1-PH	34401	2	PFC EQUIPMENT	0	0	0	0	5
6	3/4" x 1-1/2" SCH 40 GALVANIZED NIPPLE	75x115GN	4	GOODIN CO.	0	0	0	0	6
7	1" x 3/4" 150# GALVANIZED REDUCING COUPLING	1x75GMR	4	GOODIN CO.	0	0	0	0	7
8	2-1/2" SS CASE LIQ. FILL PRESS. GAUGE 0-100 PSIG	25-2500BL-02L-100 #	3	DRAUGHTRIDGE SALES	0	0	0	0	8
9	1" x 6" SCH 40 GALVANIZED NIPPLE	1x6GN	3	GOODIN CO.	0	0	0	0	9
10	1" 125# BRONZE GLOBE VALVE	1BZ125GV	2	GOODIN CO.	0	0	0	0	10
11	1" BRONZE CHECK VALVE	4753K34	1	McMASTER CARR	0	0	0	0	11
12	1" x 3" SCH 40 GALVANIZED NIPPLE	1x3GN	2	GOODIN CO.	0	0	0	0	12
13	1" 150# GALVANIZED 90 DEGREE ELBOW	1GML	2	GOODIN CO.	0	0	0	0	13
14	1" ALUMINUM CAMLOCK PART "B" COUPLER	51415K12	4	McMASTER CARR	0	0	0	0	14
15	1" ALUMINUM CAMLOCK PART "E" ADAPTER	51415K62	4	McMASTER CARR	0	0	0	0	15
16	STAINLESS HOSE CLAMP	5661K55	8	McMASTER CARR	0	0	0	0	16
17	1" ID BUNA-N SUCTION HOSE	5282K65	20'	McMASTER CARR	0	0	0	0	17
18	G & L CENTRIFUGAL PUMP 1-1/2-HP 230V 1-PH	3ST1F0E4	1	PFC	0	0	0	0	18
19	1-1/2" x 6" SCH 40 GALVNZIED NIPPLE	115x6GN	2	GOODIN CO.	0	0	0	0	19
20	1-1/2" 125# BRONZE GLOBE VALVE	115BZ125GV	1	GOODIN CO.	0	0	0	0	20
21	1-1/2" BRONZE CHECK VALVE	4753K36	1	McMASTER CARR	0	0	0	0	21
22	2" ALUMINUM CAMLOCK PART "B" COUPLER	51415K15	2	McMASTER CARR	0	0	0	0	22
23	2" ALUMINUM CAMLOCK PART "E" ADAPTER	51415K65	2	McMASTER CARR	0	0	0	0	23
24	STAINLESS HOSE CLAMP	5661K12	2	McMASTER CARR	0	0	0	0	24
25	2" CLEAR VIEW PVC SUCTION HOSE	45815K22	6'	McMASTER CARR	0	0	0	0	25
26	2" 125# BRASS BALL VALVE	2BR125BV	1	GOODIN CO.	0	0	0	0	26
27	2" x 3" SCH 40 GALVANIZED NIPPLE	2x3GN	1	GOODIN CO.	0	0	0	0	27
28	3" x 2" 150# GALVANIZED REDUCING BUSHING	3x2GMB	1	GOODIN CO.	0	0	0	0	28
29	1" 125# BRASS BALL VALVE	1BR125BV	5	GOODIN CO.	0	0	0	0	29
30	1" x 2" SCH 40 GALVANIZED NIPPLE	1x2GN	5	GOODIN CO.	0	0	0	0	30
31	1" x 4" SCH 40 GALVANIZED NIPPLE	1x4GN	1	GOODIN CO.	0	0	0	0	31
32	1" 150# GALVANIZED TEE	1GMT	1	GOODIN CO.	0	0	0	0	32
33	1" GALVANIZED THREADED PLUG	1GMP	1	GOODIN CO.	0	0	0	0	33
34	2" x 1" 150# GALVANIZED REDUCING BUSHING	2x1GMB	1	GOODIN CO.	0	0	0	0	34
35	5" x 6.7# STEEL C-CHANNEL SKID FRAME	PLC 502-228	12'	McNELIUS STEEL	0	0	0	0	35
36	3/16" STEEL PUMP MOUNTING PLATE	PLC 502-210	8'	McNELIUS STEEL	0	0	0	0	36
37	0	0	0	0	0	0	0	0	37
38	0	0	0	0	0	0	0	0	38
39	0	0	0	0	0	0	0	0	39
40	0	0	0	0	0	0	0	0	40

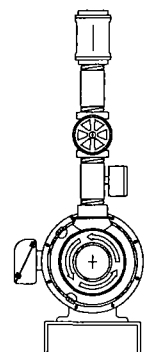
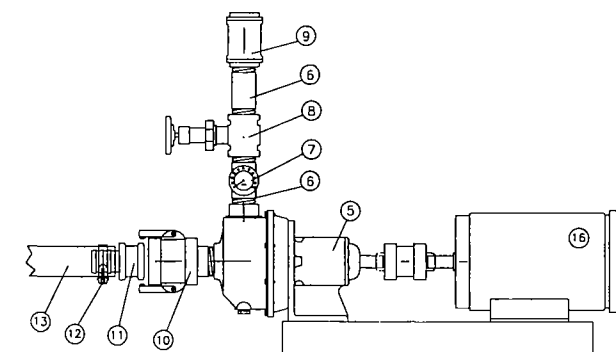
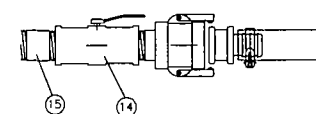
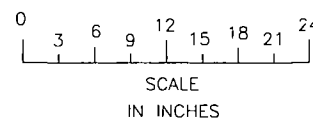
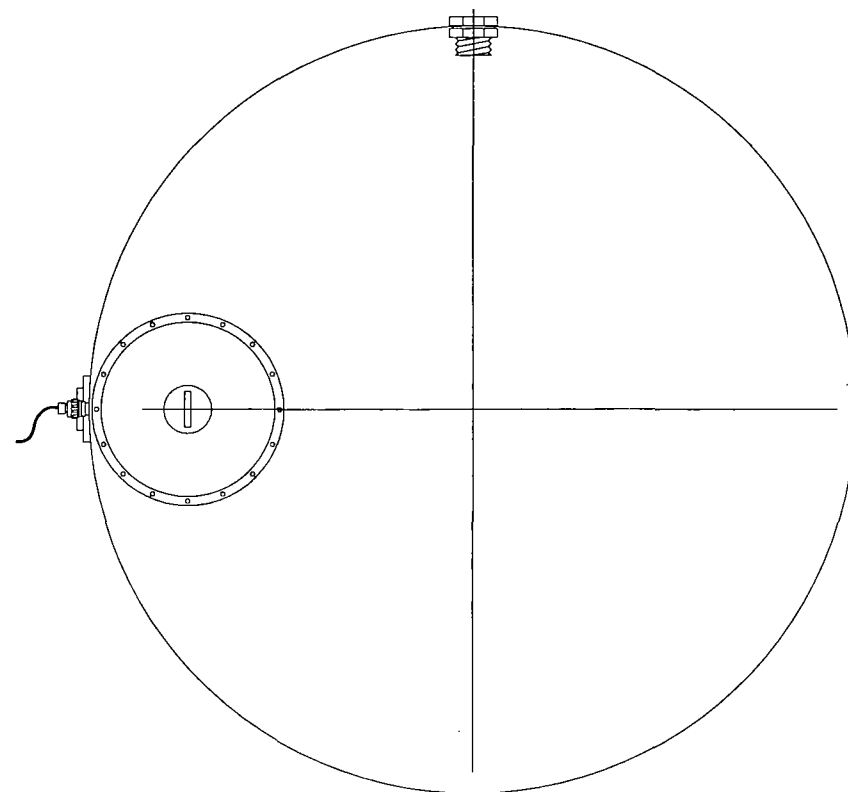
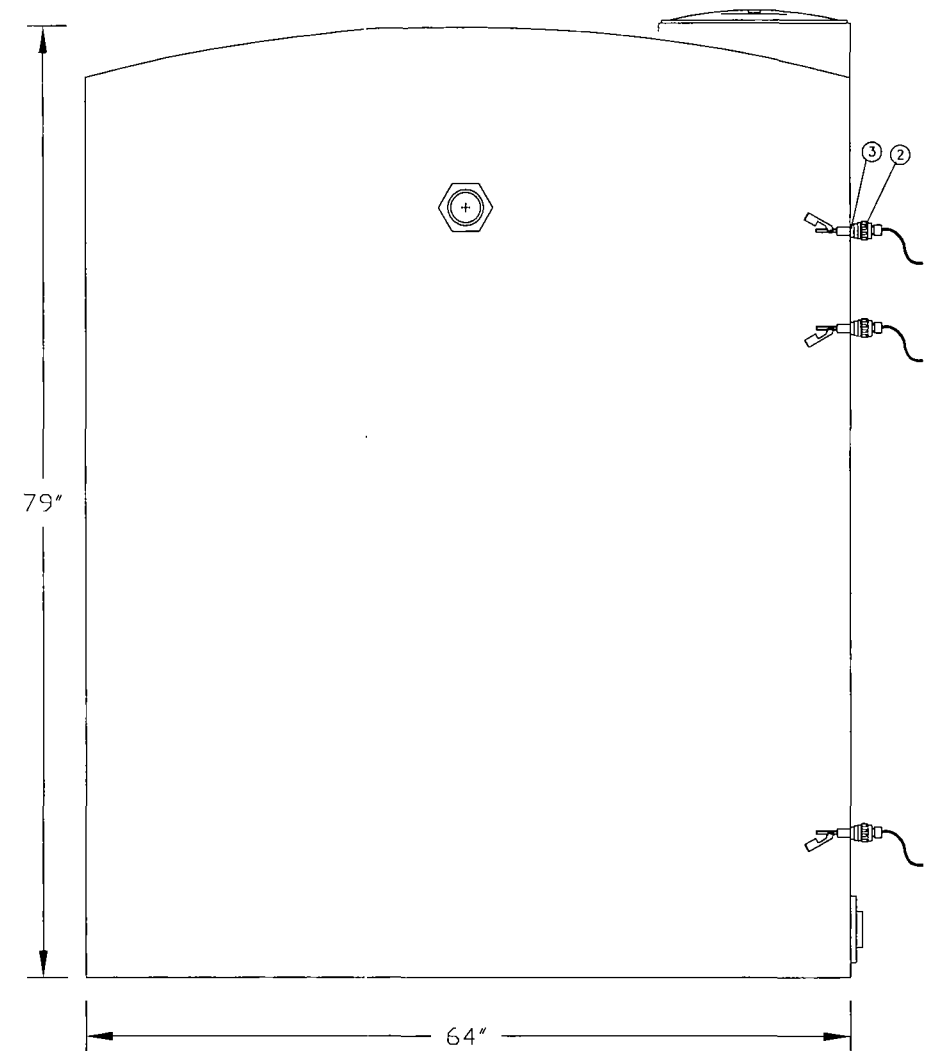
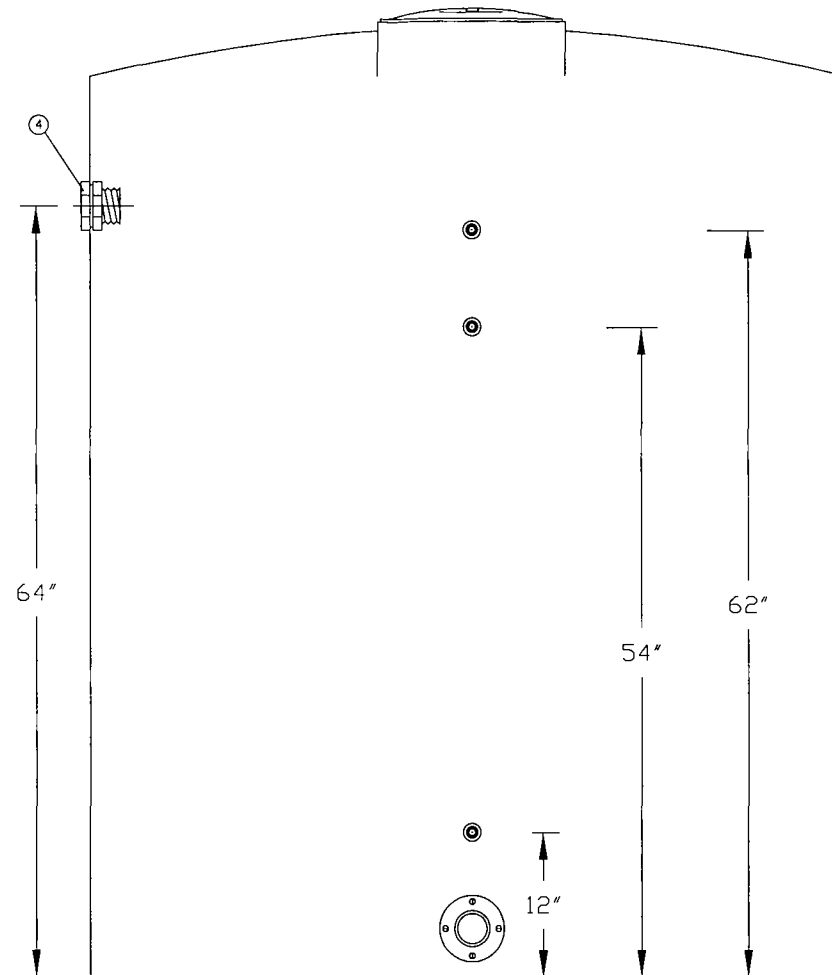
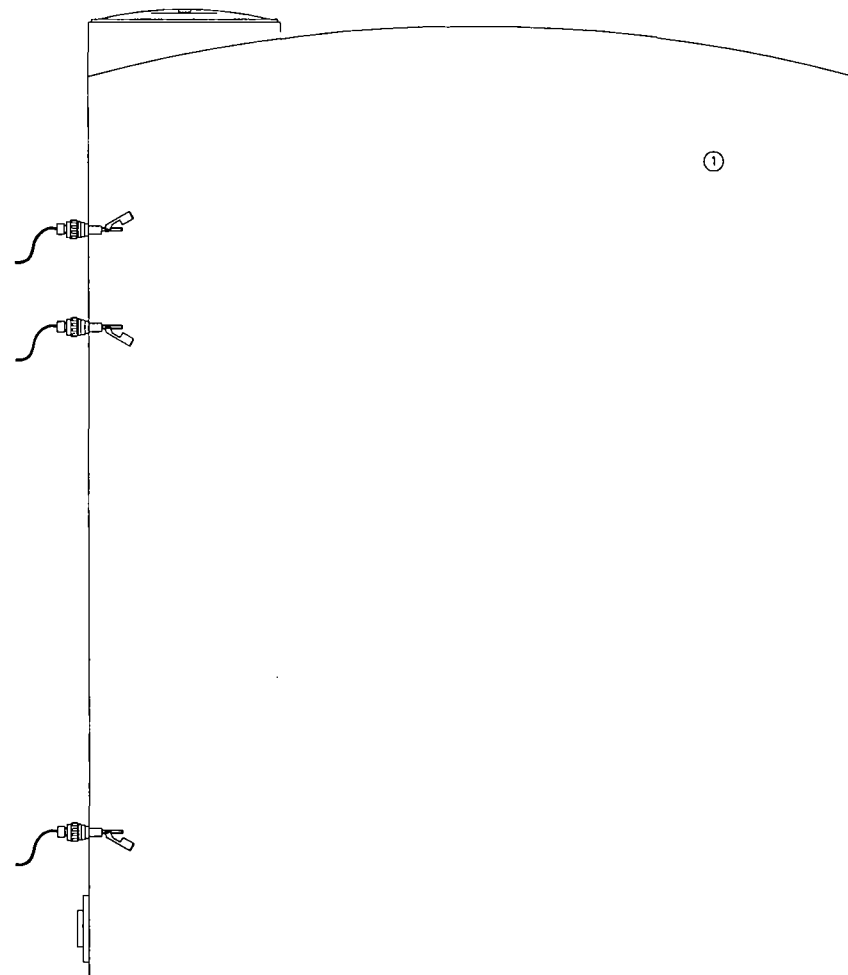


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TOLERANCES ± .250"
 DRAW NUMB. 02-072 AG-5SS-300V-HP-1P OWS PARTS

CLIENT	ENVIRONMENTAL QUALITY MANAGEMENT				DATE	10/15/02		
SITE	GARY AIRPORT				BY	SCOTT PETERSON SYSTEMS ENGINEER		
TITLE-1	OIL WATER SEPARATOR @ UP TO 100 GPM				PAGE	02	OF	02
TITLE-2	COMPONENT IDENTIFICATION				SCALE	AS SHOWN		
REVISION	01	BY	0		DATE	0		
REVISION	02	BY	0		DATE	0		
REVISION	03	BY	0		DATE	0		

WATER SURGE
TANK(S)



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TOLERANCES ± .250"
DRAW. NUMB 02-072 1000 GALLON HDPE SURGE TANK

CLIENT	ENVIRONMENTAL QUALITY MANAGEMENT			DATE	10/15/02	
SITE	GARY AIRPORT			BY	SCOTT PETERSON SYSTEMS ENGINEER	
TITLE-1	1000 GALLON HDPE SURGE TANK			PAGE	01	OF 02
TITLE-2	EQUIPMENT VIEW			SCALE	AS SHOWN	
REVISION	01	BY	0	DATE	0	
REVISION	02	BY	0	DATE	0	
REVISION	03	BY	0	DATE	0	

	DESCRIPTION	PART NUMBER	QTY	VENDOR	PURCHASE ORDER	DATE ORDERED	COST	MOUNTED/LOOSE	
1	NORWESCO 1000 GALLON HDPE SURGE TANK	40152	1	INDELCO PLASTICS	0	0	0	0	1
2	PLC 3/4" SIDE MOUNTED LEVEL SENSOR w/ 25' LEAD	PLC LS-3/4	3	PLC	0	0	0	0	2
3	3/4" HDPE HALFCOUPLING	PLC 510-205	3	PLC	0	0	0	0	3
4	2" SCH 80 PVC THREADED BULKHEAD FITTING	60431020	1	SEELYE PLASTICS	0	0	0	0	4
5	G & L CENTRIFUGAL PUMP END	3STFRMB4	1	PFC	0	0	0	0	5
6	1-1/2" x 6" SCH 40 GALVANIZED NIPPLE	115x6GN	2	GOODIN CO.	0	0	0	0	6
7	2-1/2" SS LIQ. FILL PRESS. GAUGE 0-100 PSIG	25-2500BL-02L-100#	1	DRAUGHTRIDGE SALES	0	0	0	0	7
8	1-1/2" 125# BRONZE GLOBE VALVE	115BZ125BV	1	GOODIN CO.	0	0	0	0	8
9	1-1/2" BRASS CHECK VALVE	4753K36	1	McMASTER CARR	0	0	0	0	9
10	2" ALUMINUM CAMLOCK PART "B" COUPLER	51415K15	2	McMASTER CARR	0	0	0	0	10
11	2" ALUMINUM CAMLOCK PART "E" ADAPTER	51415K65	2	McMASTER CARR	0	0	0	0	11
12	STAINLESS HOSE CLAMP	5661K12	2	McMASTER CARR	0	0	0	0	12
13	2" CLEARVIEW PVC SUCTION HOSE	45815K22	6'	McMASTER CARR	0	0	0	0	13
14	2" 125# BRASS BALL VALVE	2BR125BV	1	GOODIN CO.	0	0	0	0	14
15	2" x 4" SCH 40 GALVANIZED NIPPLE	2x4GN	1	GOODIN CO.	0	0	0	0	15
16	3-HP 230V 1-PH 3600 RPM EXP. RIGID BASE MOTOR	L5028T	1	BALDOR MOTORS	0	0	0	0	16
17	0	0	0	0	0	0	0	0	17
18	0	0	0	0	0	0	0	0	18
19	0	0	0	0	0	0	0	0	19
20	0	0	0	0	0	0	0	0	20
21	0	0	0	0	0	0	0	0	21
22	0	0	0	0	0	0	0	0	22
23	0	0	0	0	0	0	0	0	23
24	0	0	0	0	0	0	0	0	24
25	0	0	0	0	0	0	0	0	25
26	0	0	0	0	0	0	0	0	26
27	0	0	0	0	0	0	0	0	27
28	0	0	0	0	0	0	0	0	28
29	0	0	0	0	0	0	0	0	29
30	0	0	0	0	0	0	0	0	30



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TOLERANCES ± .250"
DRAW. NUMB. 02-072 1000 GALLON HDPE SURGE TANK PARTS

CLIENT	ENVIRONMENTAL QUALITY MANAGEMENT				DATE	10/15/02			
SITE	GARY AIRPORT				BY	SCOTT PETERSON SYSTEMS ENGINEER			
TITLE-1	1000 GALLON HDPE SURGE TANK				PAGE	02	OF	02	
TITLE-2	COMPONENT IDENTIFICATION				SCALE	AS SHOWN			
REVISION	01	BY	0			DATE	0		
REVISION	02	BY	0			DATE	0		
REVISION	03	BY	0			DATE	0		



DEPTH
TRANSMITTERS

PRESSURE SYSTEMS

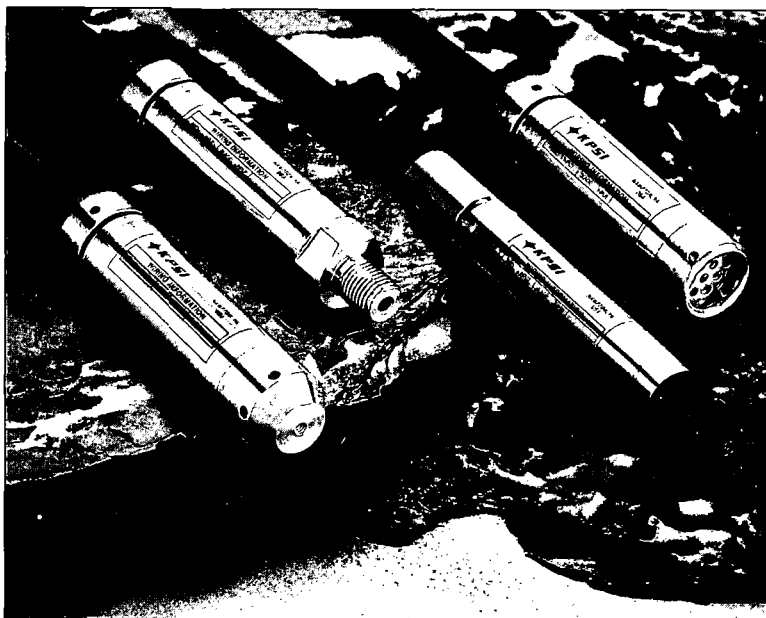
KPSI™ Level & Pressure Transducers

User's Manual

7th Edition

April 2002

Order On-line!



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Hampton, Virginia 23666**

(757) 865-1243

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E-Mail: sales@PressureSystems.com

Internet: www.PressureSystems.com

A Weston Company of The Roxboro Group PLC

Introduction

Pressure Systems is an ISO-9001 certified U.S. manufacturer of submersible and above ground pressure transducers for environmental, industrial and municipal applications. Our KPSI line of transducers have been specified in hundreds of projects throughout the United States and Canada by geologists, system integrators, national engineering firms and a variety of government agencies. Typical applications include, but are not limited to, pump control, tank level monitoring, sewage lift station operation, reservoirs, weirs, flumes, site remediation, stormwater/well monitoring, pump/pipeline pressures and compressor pressures.

800 Number Support

Twelve hours a day, Monday through Friday, knowledgeable technical assistance is provided by factory personnel (800-328-3665). We work with customers to understand their specific needs and then recommend the pressure measurement device that best fits their application. If no standard is available, we will propose optional modifications to standard products or new product designs to solve the pressure measurement problem.

Product Quality

Each pressure transducer is shipped with its own calibration sheet that describes its exact performance characteristics. This information is NIST traceable! We also keep a duplicate record of each calibration sheet for three years in our record archives in Hampton, VA. Should you misplace your calibration sheet, we can fax or mail a duplicate to you. In emergencies, such information will gladly be provided during a phone discussion.

Website and E-Mail

Visit our website at www.PressureSystems.com to look at our latest new product releases, application notes or product specifications then e-mail your questions and comments to us.

E-commerce

Orders may be placed on-line by visiting our website (www.PressureSystems.com) or by contacting the factory or local representative.

Minimum Order

\$50.00

Applicable Products

This manual provides information applicable to the use of the following KPSI water level transducers:

Series 169/173

Series 200

Series 700/710/720/730/735

Series 300/320/330/335

Series 300DS

Series 27/28/30/35

Series 750

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1.0 Order Administration

Order Entry

We accept orders by fax, phone, mail and e-mail. To ensure accuracy, all orders are reviewed by technical specialists before being submitted for production. Orders are scheduled into production within 4 hours of order receipt.

E-commerce

Orders may be placed on-line by visiting our website (*www.PressureSystems.com*).

Payment

Net 30 terms are available upon approval of credit. We accept Visa/MasterCard, corporate checks, money orders and cash. Many orders are shipped C.O.D.

Method of Delivery

All orders are shipped freight on board (FOB) from our factory in Hampton, Virginia USA. We typically ship UPS, but will use any shipper you specify.

Delivery Times

Shipment for standard products is typically 5 working days but we do offer an Expedited Shipment Option for selected products.

2-4 working days from receipt of order is \$100.00 per unit.

Warranty Protection

Any transducer/transmitter that is less than 2 years old (see DOM) which does not meet the product's specifications and exhibits **no obvious physical damage to the housing, sensor, or cable (cuts)**, will be replaced under warranty.

Units 2-3 years old: Units that fall within this age group and exhibit no obvious physical damage to the housing, sensor, or cable (cuts), are replaced at a discounted list price.

Units greater than 3 years old: Units that fall within this age group are not repaired or replaced under warranty. The customer will need to contact our Sales Department at **1-800-328-3665** for replacement.

Example DOM: (The DOM is located on each transducer/transmitter housing)

DOM: 9914

99 is the last two digits of the year of manufacture (1999)

14 is the week of manufacture (14th week of 52 week year)

- When returning units to the Repair Department, please include the vent filter or aneroid bellows.
- **Vent filters should be changed when they are 75% spent (pink).** Do not remove the old vent filter until a new one is available. The number one failure mode is moisture and corrosion damage due to lack of maintenance of the vent filter. Remember to remove yellow protective cap upon operation. This will allow air to breathe into dessicant fill.
- There is a 90 day warranty on all repairs.

Intrinsic Safety

Most of our products have FM, UL, CSA and ATEX certification for intrinsic safety as well as CE approval for EMC. Several of our product lines also carry ABS approval.

2.0 Product Description and Use

General Characteristics

Our submersible pressure transducers use isolated diaphragm sensors that are specifically designed for use with hostile fluids and gases. These sensors utilize a silicon pressure cell that has been fitted into a stainless steel or titanium package with an integral, compliant stainless steel or titanium barrier diaphragm. This sensor assembly is housed in a rugged 316 stainless steel or titanium case which provides for a variety of pressure inputs from 0-2 through 0-300 psi. Our devices feature internal signal conditioning. Standard outputs are 4 to 20 mA, 0 to 100 mV and 0 to 5 VDC. Other outputs are available upon request.

All units containing active electronic components have surge and reverse polarity protection. For ease of use in the field, our transducers are permanently etched with our logo and name, wiring information, part number (P/N), serial number (S/N), date of manufacture (DOM), range, excitation and output. Pressure transducers are offered in diameters of 1.0 and .74 inches.

Care and Handling

Our submersible transducers are designed for rugged use. However, they need protection from overpressure and sharp impact. When lowering them into a liquid, penetrate the surface slowly and only to the depth necessary. Avoid dropping the unit from above the surface. Clean all transducers by rinsing them in a mild detergent. Direct probing of the diaphragm or attempts to remove protective screens will damage the sensor, voiding the warranty.

Calibration

All pressure transducers are shipped with calibration information unique to each transducer. Make sure you keep each calibration report. However, should you misplace your calibration sheet, you can contact the factory to have a duplicate faxed or mailed to you.

3.0 Product Accessories and Options

Nose Caps

There are several different user-installable nose caps for the Series 700, 710, 720, 730, 735 submersible pressure transducers. The closed-faced ported cap (316 SS, titanium or Delrin) with #8-32UNC-2B threaded hole is best used where weights are required and for those installations where users may encounter sharp, protruding objects. The open-faced cap which allows maximum contact with the liquid media is ideal for wastewater and "greasy" applications where clogging of the sensor is a concern. The 1/4" male NPT pressure cap is not only useful for calibration purposes but also allows the device to be used as a submersible or above ground pressure transducer. The piezometer cap allows the unit to be buried in saturated soil without damage to the sensor diaphragm.

Series 810 Vent Filter or Series 815 Bellows

We supply with each submersible pressure transducer, a protective barrier against moisture collecting in the cable vent tube. This ensures reliable operation and long life as it protects sensitive electronic components from mildew, corrosion, rust and prevents the formation of a liquid column in the vent tube. Any such column directly affects calibration.

Series 820 Sacrificial Anode

The Series 820 Sacrificial Anode provides cathodic protection against galvanic corrosion for our submersible pressure transducers. Galvanic corrosion occurs when dissimilar metals are placed in contact with an electrolyte. This condition causes a potential difference to exist between the two metals, causing electron flow between them. Corrosion of the less corrosion-resistant metal is increased and attack of the more resistant metal is decreased. The Series 820 Sacrificial Anode is clamped to the exterior of the transducer. We also offer a 1" diameter version that attaches to the nose cap of the transducer.

Our sacrificial anodes are made from a special zinc alloy formulated to guarantee continued effectiveness over long periods. Because the anodes are 95% galvanic, they will not corrode unless there is an electrolytic demand. The anode maintains a high driving potential throughout its 12 month life, is self-sluffing and always exposes new zinc for the best possible protection. For those applications where cable buoyancy is a problem, the nominal 21 ounce sacrificial anode can be substituted for hanging weights.

Polyurethane & Tefzel® Jacketed Cable

Most installations of our submersible pressure transducers connect our polyurethane or Tefzel® cable to a junction box. From this junction box, users run their own cable to the required instrumentation. Polyurethane is used for most applications while Tefzel® is recommended for highly corrosive environments.

Specifications for our standard polyurethane and Tefzel® jacketed cable are as follows:

Specifications	Standard Submersible Cable
Weight	0.05 lbs/ft
Min. OD	0.28"
Max OD	0.31"
Conductors	4 - 22 AWG
Insulation Conductors Outerjacket	PVC Polyurethane or Tefzel®
Shield	36 gauge spiral tinned copper wire
Vent Tube	polyethylene, .060" ID

Chemical resistance of polyurethane: Potable Water, Waste Water, Borax, Butane, Animal Fat, Carbonic Acid, Citric Acid, Cod Liver Oil, Corn Oil, Glycerin, Glycol, Mineral Oils, Potassium Nitrate, Potassium Sulfate, Silicone Oils, Stoddard Solvent, Tannic Acid (10), Tartaric Acid, Turbine Oil.

Chemical resistance of tefzel®: Acetic Acid (Glacial), Acetic Anhydride, Acetone, Aluminum Chloride, Anti-Freeze, Bromine, Calcium Chloride, Calcium Hydroxide, Chlorine, Copper Chloride, Ferrous Chloride, Hydrochloric Acid, Ketones, Lacquer Thinners, Sulfuric Acid.

The vented cable termination end is specially prepared at the factory to eliminate future moisture migration down its length. It can be noticed where the lead wires emerge from under the jacket that a potting material plus shrink tube "boot" have been added. Every effort should be made to leave this feature intact. Should the cable be longer than is needed for the particular installation, it is recommended that the excess length be accommodated in a service loop and that the potted end of the cable NOT be shortened.

The cable attached to this instrument is specifically engineered for submersible applications. The polyurethane outer jacket provides long term reliability under most conditions. The cable should be handled carefully, however, as the jacket may be subject to cutting should it be "raked" over extremely sharp edges. To guard against water incursion should an inadvertent cut occur, we have incorporated an exclusive "water block" feature immediately beneath the jacket. This feature makes the cable "self-sealing" in all but the most extreme cases. The cable is fully shielded, with the shield connected to the metal housing at the transducer end and terminated in a blue-insulated wire at the termination end. The shield should always be terminated to a good earth ground, unless the transducer is installed in an area where electrolytic corrosion is known to be a serious problem.

Lightning Protection

We can provide optional lightning and surge protection for the 0-5 VDC and 4-20 mA output of our 1 inch diameter units. This is achieved through the use of 2 protectors. One is housed in a 4 inch long, 1 inch OD 316 SS tubing attached directly to the non-pressure sensing end of the transducer while the other is located at the surface and grounded to a DIN-3.

Featuring quick response and low clamping voltages, these devices protect against fast rising voltage transients as well as severe current surges associated with lightning discharges up to 20,000 amperes. Following a surge, the protector automatically restores the line to normal operation and awaits the next surge without having to reset a breaker or replace a fuse. Transducers installed with this option have a lifetime warranty against voltage surge.

Please note: Input voltage should be kept high enough to cover ohm resistance, ie. if using 250 ohm resistance, then input voltage must be at least 15 VDC.

½" Male NPT Conduit Fitting

Submersible pressure transducers can be attached to a rigid conduit and the cable run through the conduit. To achieve this, all of our submersible transducers can be fitted with an optional ½" NPT male conduit fitting where the cable exits the transducer. This fitting can then be mated to a standard rigid conduit.

Variety of Electrical Outputs

Most applications call for a 0-5 VDC, 4-20 mA or a 0-100 mV output. But where necessary, our transducers offer a broad choice of possibilities including, among others, 0-10 VDC, 0-2.5 VDC, or ratiometric mV/V.

Temperature Output

A 4-20 mA output for temperature is also available for most transducers having a 4-20 mA pressure output. The temperature sensor requires an excitation of 9-30 VDC and is calibrated for a temperature range of -20 to 60°C with an accuracy of $\pm 2^\circ\text{C}$. Wiring information: White = + Excitation, Green = Signal out. Please see Appendix B.

Cable Hanger

We can supply an optional cable hanger to help end users secure the cable. The cable hanger can be positioned anywhere on the cable by pushing the ends together. Once positioned, the cable hanger expands and provides a snug grip on the cable.

When mounting the transducer in a well casing, the cable hanger can be secured to a hook on the well plate or an eyebolt may be attached to the side of the well casing. The cable hanger loop is then secured to the eyebolt by using any number of types of fasteners. A similar technique can be used when working in still wells for surface water level measurement. In this case, the loop-end of the cable hanger can be attached directly to a screw or bolt bored into the still well shelf.

Cable Splicing Kit

Our field-installable cable splice allows you to splice our polyurethane and Tefzel® cable. It is most commonly used for well applications where the more expensive Tefzel® cable is required for suspension in corrosive media where the liquid level is fairly shallow but the well is hundreds of feet in depth. It also is used in those emergency situations where cable must be spliced together to get an application up and running.

4.0 Installation & Maintenance Tips

General Installation Procedures - Submersible Units

Most installations either suspend our submersible transducer in a perforated 1 ½" or 2" PVC instrumentation stilling well or attach the transducer (using our optional conduit fitting) to a rigid conduit. It is not advisable to tie the transducer to the pump or piping, as a problem with the transducer would then require that the pump be pulled (very expensive).

A minority of applications use our optional bracket to clamp the transducer to a fixed object (i.e., wall, ladder, step) or require the unit to be suspended without any protective still well or attachment device. In all installations, care should be taken to ensure no damage occurs to the cable as cable damage represents one of the most frequent causes of transducer failure.

Cable Lengths

The maximum length of cable to be used with our submersible pressure transducers is largely dependent upon the type of electrical output of the pressure transducer. For a 0-5 VDC output, a maximum cable length of 100 feet is recommended as a voltage output is more susceptible to electrical interference than a 4-20 mA signal.

A 4-20 mA signal can be transmitted much longer distances depending upon such factors as temperature, wire size, length of wire, power supply and voltage requirements of any devices to be powered. At 25°C the 22 AWG conducting copper wire used in our polyurethane jacketed cable has a resistance of 16.45 ohms per 1000 feet.

Using Ohms Law ($E=IR$) where E =voltage, I =current and R =resistance, one finds that a 20 mA signal requires .329 volts to drive it along 1000 feet of 22 AWG copper wire ($E=16.45 \times .020$).

To find out how much voltage is required to drive our Series 700 submersible pressure transducer's 4-20 mA signal 10,000 feet, just add the minimum power requirement of the 700 (9 VDC) to the resistance offered by 10,000 feet of our polyurethane jacketed cable ($10,000 \div 1000 \times .329 = 3.29$). The resulting power requirement is 12.29 VDC ($9 + 3.29$).

Reverse Signal

For some applications, it is important to know how far the water is from the top of the tank or the surface of the ground. If specified by the customer, our factory can set the transducer so that zero pressure reads full scale electrical output and maximum pressure reads zero output.

Drying Transducers

If you happen to get water in the vent tube and in the submersible pressure transducer, coil the cable and transducer in a pan and place the pan in an oven at 50°C for 2 hours. This on-site remedy may do the trick. Be careful that the oven temperature does not exceed 50°C. Otherwise, you may damage the transducer and cable.

4-20 mA Wiring

To connect a 2 wire 4-20 mA transducer to a typical power supply and mA meter, connect the + (red) lead of the transducer to the + terminal of the power supply. Connect the - (black) lead of the transducer to the + input terminal of the meter. Connect the - input terminal of the meter to the - terminal of the power supply with a length of 22-24 AWG wire. Connect the blue shield wire to a good earth ground.

VDC Wiring

To connect a 3 wire VDC output transducer to a typical power supply and the voltmeter, connect the - terminal of the power supply to the - input terminal of the meter with a length of 22-24 AWG wire. Connect the - excitation (black) lead of the transducer to the - input terminal of the meter. Connect the + input terminal of the meter to the signal lead (white) of the transducer. Connect the + terminal of the power supply to the + lead (red) of the transducer. Connect the blue shield wire to a good earth ground.

Cable Protection

An inexpensive way to protect the cable from damage is to order the submersible pressure transducer with a ½" conduit attachment. Connect an inexpensive flexible 5/8" garden hose to the ½" conduit fitting with an equally inexpensive female PVC ½" NPT x 3/4" NHT swivel fitting, available at your local hardware store.

Bending of Cable

Our polyurethane and Tefzel® jacketed cables are quite flexible. Care needs to be taken to ensure that when bending the cable to suit your installation you do not crimp the vent tube inside the cable. Consequently, do not bend the cable more than a radius of 1 inch.

Cable Compression

Many users require a compression fitting to secure our Tefzel® and polyurethane jacketed cable as it enters a junction box. Care needs to be taken that you do not overtighten the fitting so as to damage the cable.

Appendix A

Frequently Asked Questions

1. I need proof pressure much greater than 1.5 X. How can you help me?

We can provide 5 X over pressure protection on most ranges if you can accept a thermal error of 0.1% full scale output per degree Celsius.

2. What installation ideas do you have to help me get rid of electrical noise interfering with the signal?

An ounce of prevention goes a long way. Either try to eliminate the source of noise or move the transducer as far away from it as possible. We strongly encourage you to secure our cable shield to a good earth ground and that you use a 4-20 mA signal output. Armed with these precautions and the fact that many of our transducers are CE approved for electromagnetic interference, you should have few problems.

3. My cable on the submersible always seems to get cut and damaged. What am I doing wrong?

This is the most common problem that our users encounter. Make sure that all of your colleagues and staff understand the importance of handling the cable with care. The cable should not be bent around rough or sharp edges. Always use a cable reel during transport. Where possible, suspend the unit in a perforated 2" PVC pipe and thread the cable through protective conduit to the nearest junction box. This is a problem that KPSI directly addresses with the water block feature in our cable.

4. I have an application where the transducer is frequently damaged by voltage spikes. What can be done to prevent this?

At a minimum, make sure the cable shield is connected to an earth ground as near as possible to the transducer. We can provide a surge protection kit for both our below and above ground transducers and transmitters. These kits will handle typical spikes that might come in through the power lines as well as surges that travel through the ground due to nearby lightning strikes.

5. How much impact shock can your submersible transducers withstand?

The lower pressure ranges can be damaged if dropped from several feet onto an unforgiving surface like concrete, so we recommend that the protective shipping foam remain in place until the unit is installed.

6. What is the response time of your transducer?

From initial power up, the transducer output will stabilize within a fraction of a second. The frequency response is rather low, probably less than 1 kHz, but it really depends on the application, the media, plumbing, etc. Call our factory for application assistance if frequency response is critical in your application.

7. How do I attach your vent filter or aneroid bellows to my cable vent tube?

The vent filter can be mounted anywhere convenient, preferably out of the weather. It can be mounted in any position and connects to the cable vent tube via the extension tube with metal connector tube provided. The aneroid bellows must be mounted in a way that its movement is not encumbered. It is provided with a mounting base.

8. What is the best way to mark my cable?

Use white vinyl marking tape available from your local hardware or electronic stores. These same stores may also sell cable marking kits.

9. Any ideas for preventing marine growth on your submersible transducers?

You might want to try waterproof grease. Remove the threaded nose cap to facilitate applying the grease. Take care when applying the grease not to trap air bubbles against the sensing diaphragm and not to damage the diaphragm.

10. How many pressure measurements can you make before the diaphragm on the pressure sensor fails?

In normal operation - millions of cycles. We find that transducer failure is rarely due to diaphragm fatigue.

11. What is the mean time between failure for your submersible pressure transducer?

Most failures are due to misuse by the end user. However, properly installed units last tens of thousands of hours.

12. What is the turnaround time on repairs?

Once we receive a unit into our facility it takes approximately 5 working days.

13. What is the longest length of cable you have attached to a submersible transducer?

Two thousand feet.

14. Why do you use 316 SS housings and sensors for your standard transducers?

It offers a good combination of corrosion resistance and reasonable cost. As an option, we do offer Titanium for very corrosive environments.

15. What wire gauge should I limit myself to when connecting to your 22 AWG wire?

Use 22 AWG or greater.

16. Does it make any difference if I mount the transducer in a vertical or horizontal position?

No. Our units have a minimum amount of position sensitivity. You should mount it in the same position, however, throughout the measurement cycle.

17. What is the longest length of time one of your products has run continuously?

Since 1986, the year we first started manufacturing all-media pressure transducers.

18. What happens when you freeze your transducer in a column of water?

We have frozen our submersibles in a container of water in a home freezer, with no resulting damage. However, depending on the pressure range of the unit, over pressure of the unit is possible. In harsh environments where debris is common and ice shifts, you might expect damage to both the transducer and cable.

19. What are the most common reasons customers keep buying your products?

No hassle service.

Quick response to problems.

Reliable, long lasting products.

Rapid delivery.

We offer lightning protection lifetime warranty.

Use 800 numbers for order entry and support.

Excellent pre and post sales application support.

Appendix B

Wiring Diagram VDC, mA, mV and Temp Output B-2

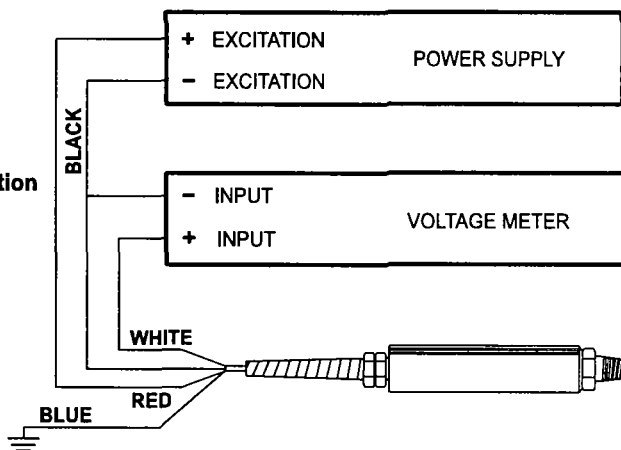
Cable Anchoring Schemes B-3

Reference Connection Schemes B-3

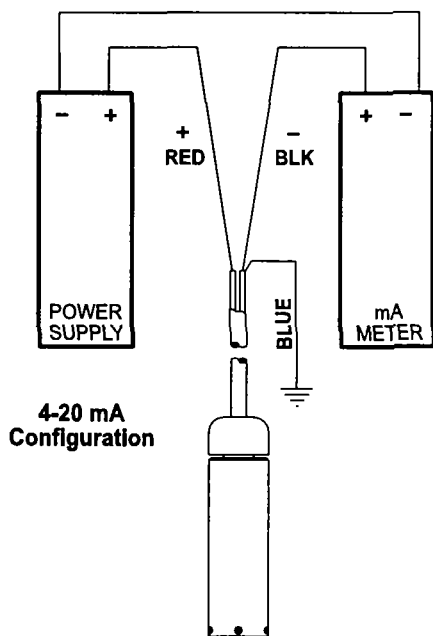
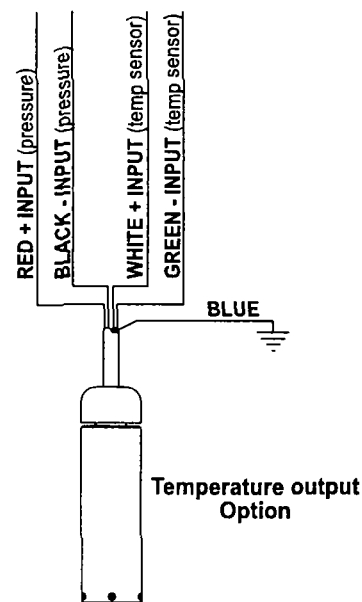
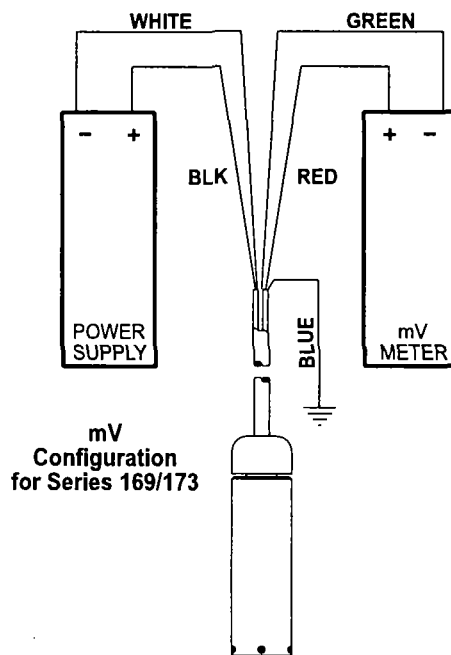
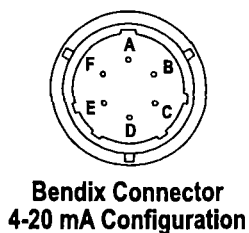
Submersible Cable Termination B-4

Quick Check Procedure for Transducers/Transmitters B-5

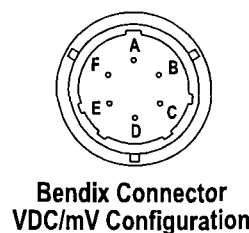
Connection Diagrams for Option-009 and -012 B-6

VDC Configuration

Note: These diagrams depict typical installations. Refer to your power supply and instrumentation manufacturer for the specifics of your application. Blue Wire = Shield

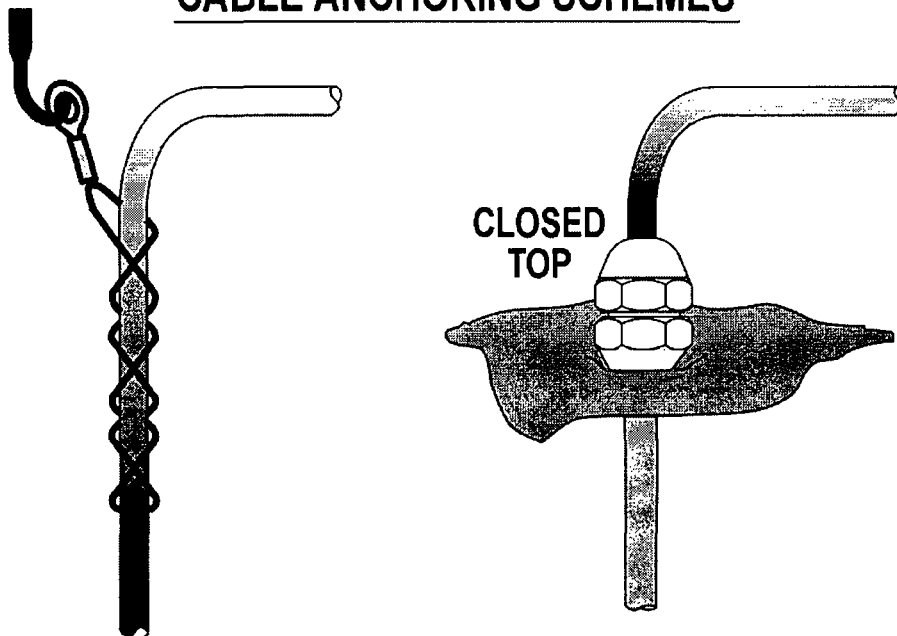
**4-20 mA Configuration****mV Configuration for Series 169/173****Bendix Connector 4-20 mA Configuration**

4-20 mA OUTPUT WIRING INFORMATION	
PIN	NAME
A	+ SUPPLY
B	- SUPPLY
C	(NOT USED)
D	(NOT USED)
E	(NOT USED)
F	SHIELD

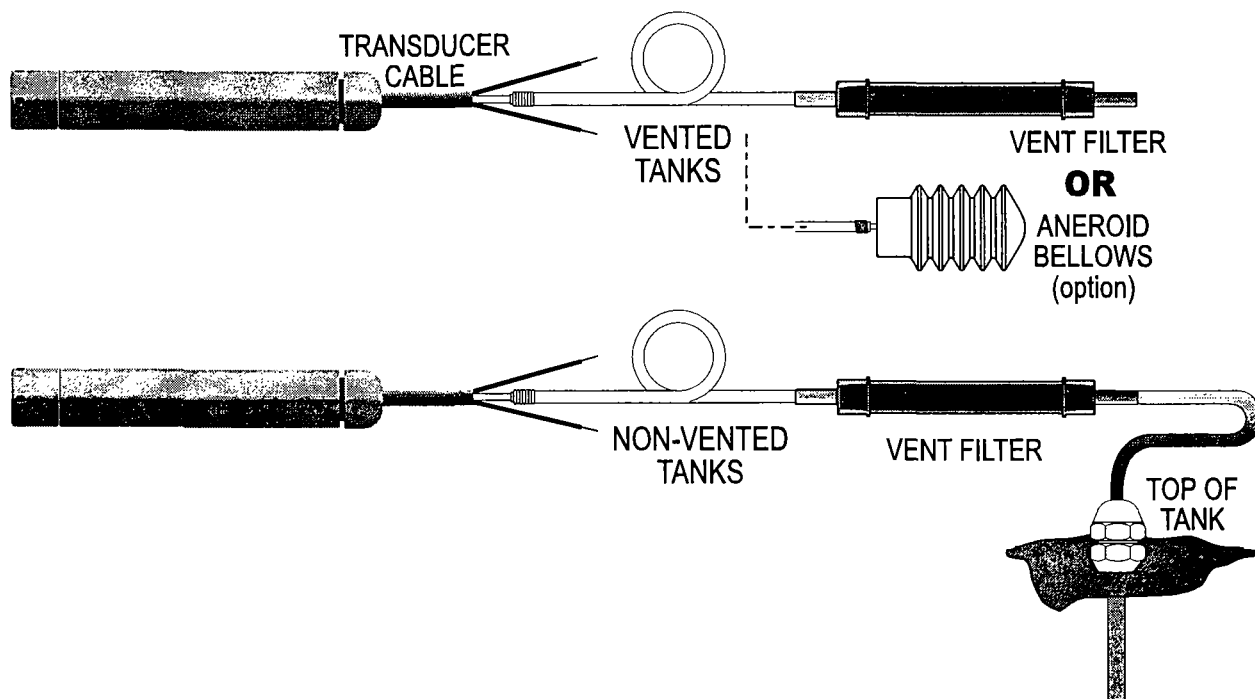
**Bendix Connector VDC/mV Configuration**

VOLTAGE OUTPUT WIRING INFORMATION	
PIN	NAME
A	+ SUPPLY
B	+ OUTPUT
C	COMMON
D	COMMON
E	(NOT USED)
F	SHIELD

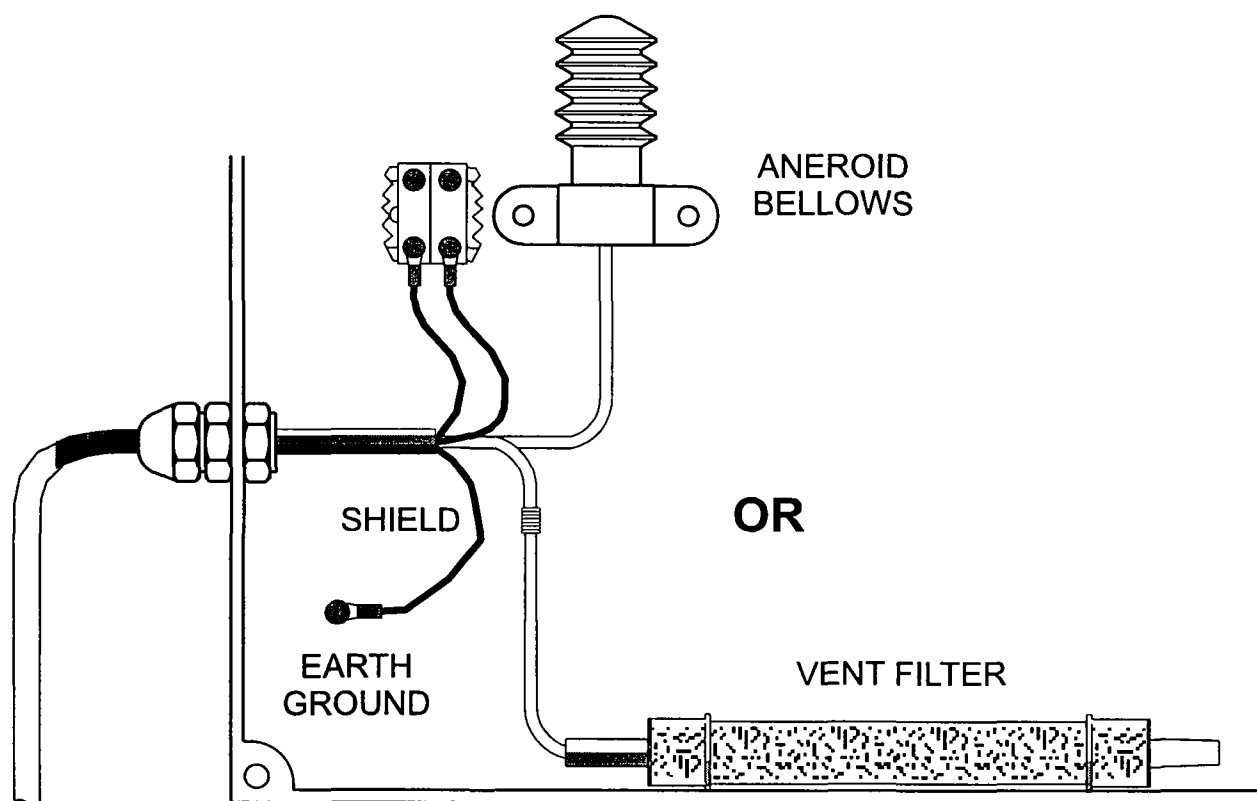
CABLE ANCHORING SCHEMES



REFERENCE CONNECTION SCHEMES



Submersible Cable Termination



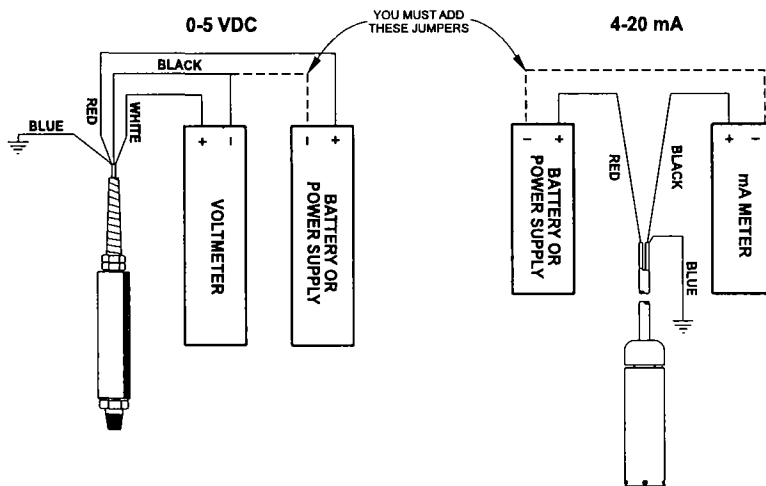
Quick Check Procedure for KPSI Transducers/Transmitters

Should a problem be encountered with a KPSI transducer or transmitter, it is sometimes helpful to test the transducer independently from the rest of the system, thereby establishing where to concentrate the troubleshooting effort.

Shown below are simple hookup diagrams for the two most common types of electrical output, a 0-5 VDC transducer and a 4-20 mA transmitter. In either case, the "power supply" can be a common 12 volt lantern battery, or even a 9 volt transistor radio battery, although the lifetime of a 9 volt battery will be limited. The meter should be a digital type capable of reading at least 2 digits to the right of the decimal point. Use 20-24 gage hookup wire or clip leads for jumpers. If your unit has other than a 0-5 VDC or 4-20 mA output, please call (800) 328-3665 for assistance.

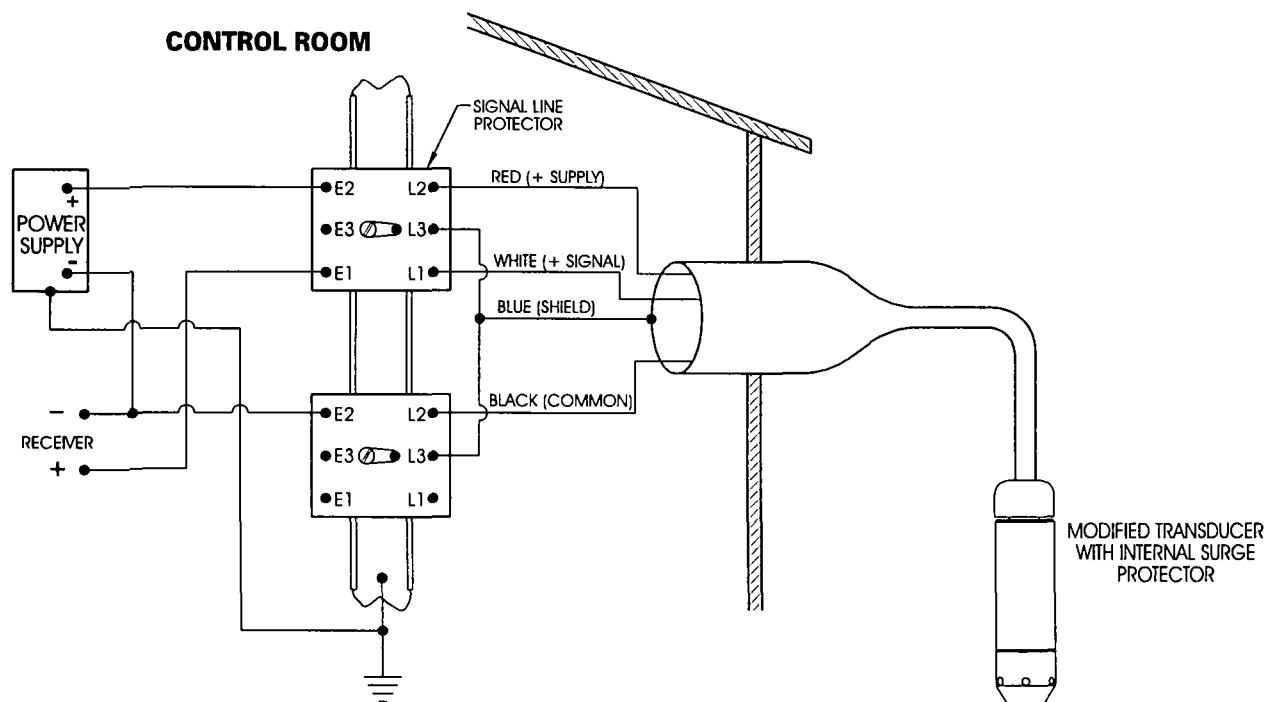
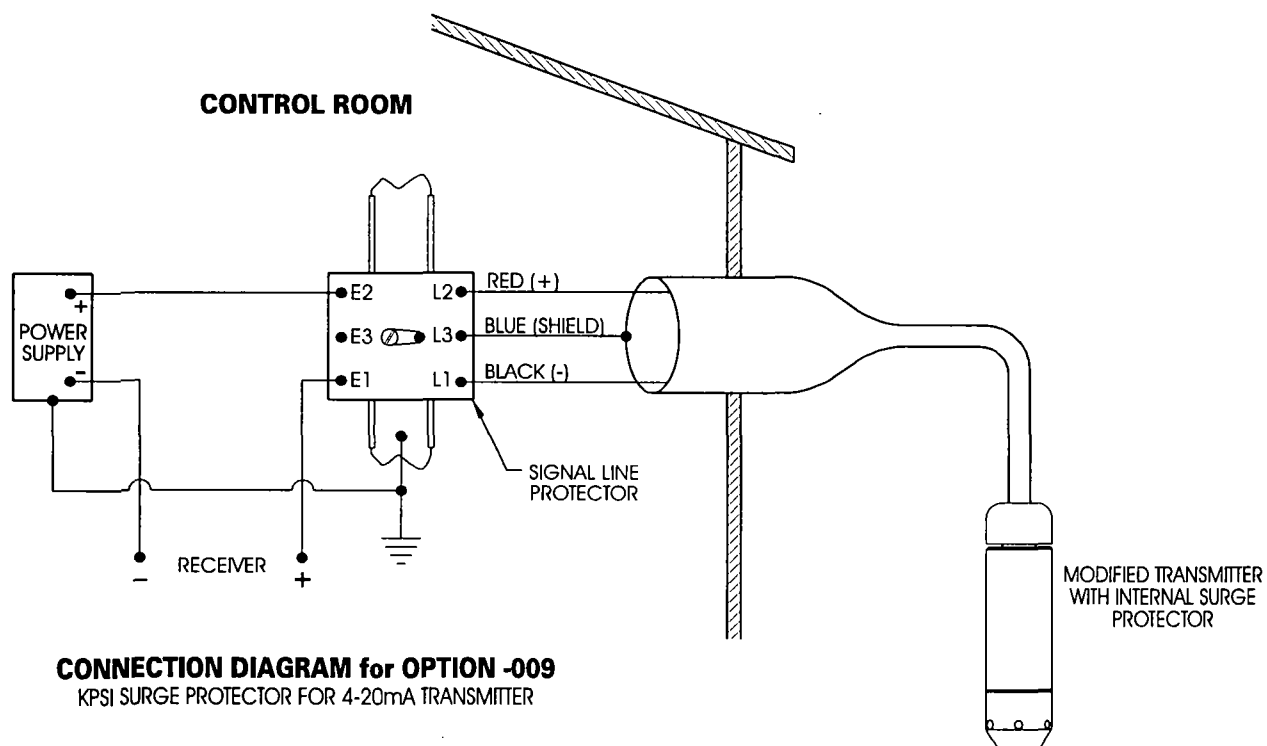
Once your transducer is correctly configured per one of the diagrams below, orient the transducer in a vertical position and then read the zero output on your meter. For a 0-5 VDC output, the zero should be between 0 and 0.060 volts, and for a 4-20 mA output, between 3.88 and 4.12 mA. If the output is outside of these limits, you may, at your option, choose to troubleshoot the transducer per the suggested measurements shown below. Otherwise, contact our Repair Department at (800) 328-3665 for a Return Material Authorization number (RMA).

If the zero output is within these limits, the problem will more than likely be found elsewhere in your system.



FURTHER MEASUREMENTS:

0-5 VDC	Should read:	4-20 mA	Should read:
+Excitation to Shield	> 2.5 Mohms	+Excitation to Shield	> 2.5 Mohms
-Excitation to Shield	> 2.5 Mohms	-Excitation to Shield	> 2.5 Mohms
+Output to Shield	> 2.5 Mohms	Shield to Housing	< 2 ohms
Shield to Housing	< 2 ohms		



TRANSFER
PUMPS

100

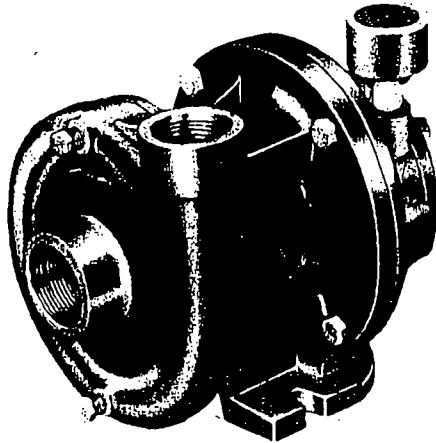
100

100

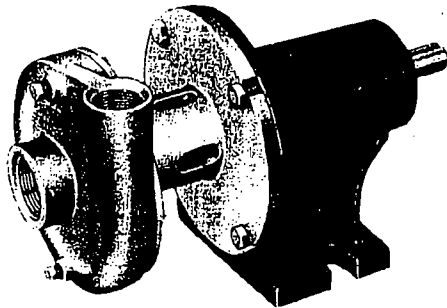
100

Flow to 160 GPM
Head to 95 ft.

Also Available:



EC100
with Air Motor Drive



SC100P
Frame Mounted

Type SC & EC

*changed
to
CD*



TECHNICAL INFORMATION

CATEGORY	SC&EC100	SC&EC150
Minimum Recommended Flow*	12 GPM	25 GPM
Maximum Solid Size	.15"	.15"
Max. Working Pressure (SC/EC)**	200/75 PSIG	
Max. Temperature (SC/EC)**	300 F	

*With Max. Impeller Diameter

**With Standard Seal and Gasket. Please contact the factory for higher temperature and pressure options.

MATERIALS OF CONSTRUCTION

PART	AI	BF	AB	SS
Volute	C.I.	C.I.	Bronze	316SS
Bracket	C.I.	C.I.	Bronze	316SS
Impeller	C.I.	Bronze	Bronze	316SS
Fasteners	Plated steel	Plated steel	18-8SS	316SS
Gasket	Syn. Fiber	Syn. Fiber	Syn. Fiber	Teflon

C.I. - Grey Cast Iron, Class 30

Bronze: 85-5-5-5

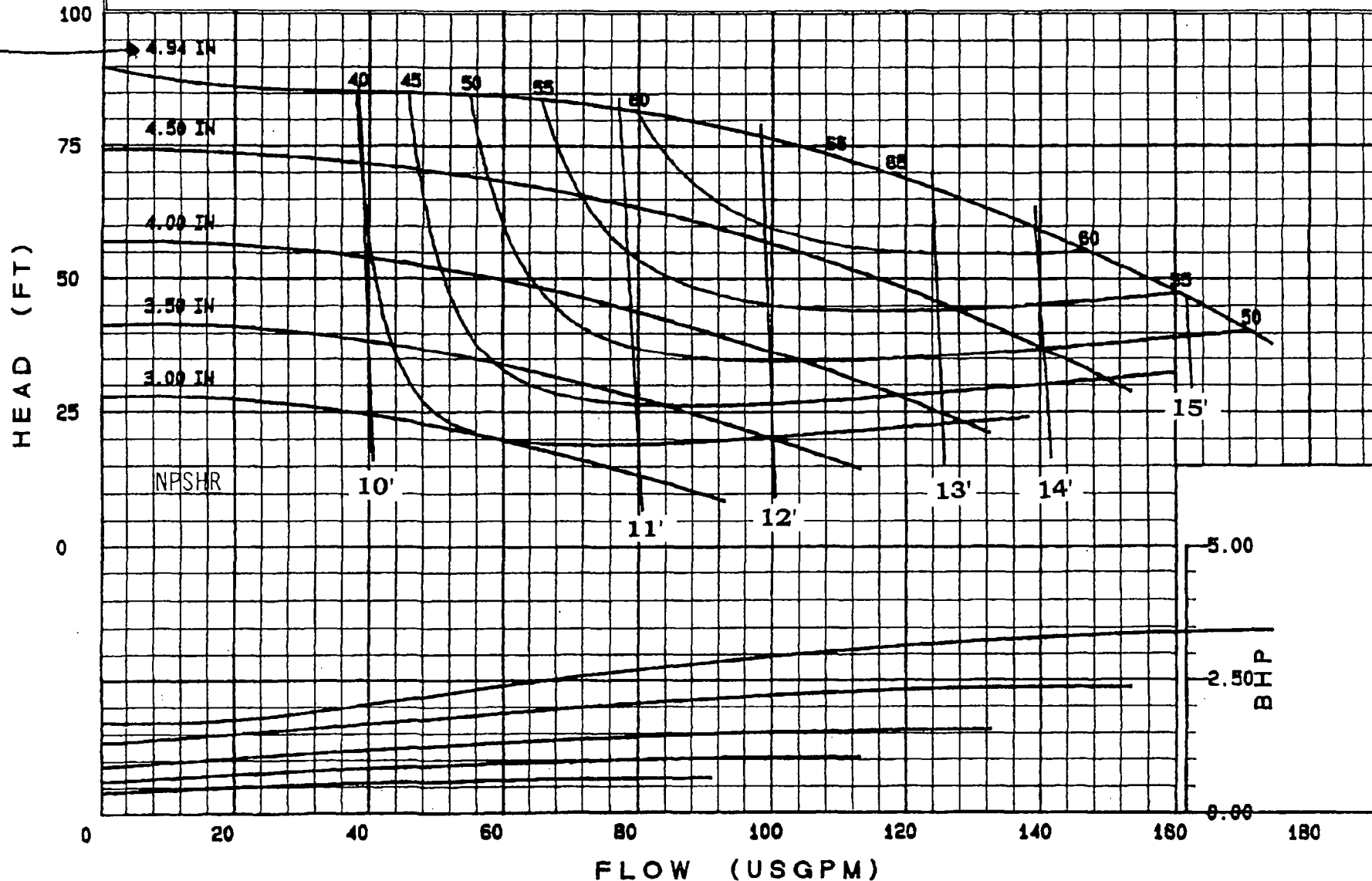
Syn. Fiber: Garlock Blue Guard 3000 or equivalent

60 Hz

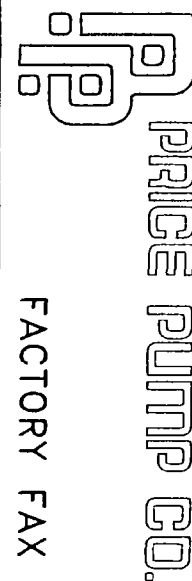
PRICE PUMP CO.
SONOMA, CALIFORNIA

CURVE NUMBER: **D010228-261-1** MODEL: **CD150 AL,AB,SS** SIZE: **1-1/2x2x5** RPM: **3500**
IMPELLER DIA: **VARIOUS** MIN. IMPELLER DIA: **3.00"** MAX. IMPELLER DIA: **4.94"** MAX. SOLIDS: **.15"**
CUSTOMER: _____ CUSTOMER'S P.O.: _____
TEST DATE: **2/28/95** VERIFIED: **5/21/01** REMARKS: **MATERIALS: IRON, BRONZE & STAINLESS**

Ph. (707) 938-8441 Fax (707) 938-0784



Received Time Apr. 21: 1:14AM



FACTORY FAX TRANSMITTAL DRAWING

#1 Pump Way P.O. Box Q
Sonoma, CA 95476 (707) 938-8441
707-FAX 938-0764

DESCRIPTION

CD100/150 BR CLOSE COUPLED MOTOR PUMP ASSEMBLY

REF. NO.

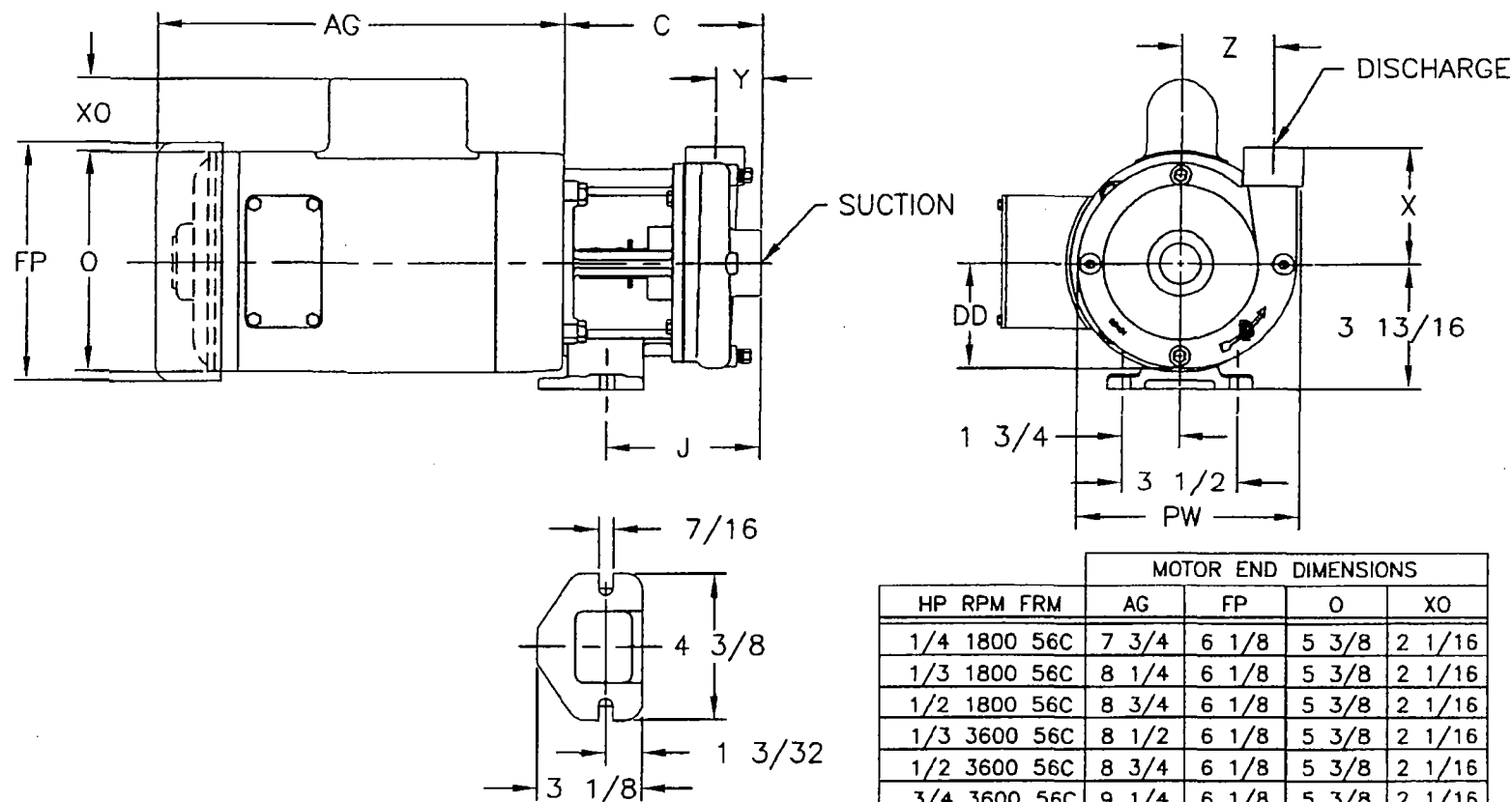
O-CDBRH

DATE

12/06/96

REV.

-



NOTE:

MOTOR DIMENSIONS WILL VARY BY MODEL AND MAKE.
DIMENSIONS ARE TO BE USED FOR REFERENCE ONLY.

ALL DIMENSIONS HAVE BEEN ROUNDED TO THE NEAREST 1/8".

				MOTOR END DIMENSIONS			
HP	RPM	FRM		AG	FP	O	XO
1/4	1800	56C		7 3/4	6 1/8	5 3/8	2 1/16
1/3	1800	56C		8 1/4	6 1/8	5 3/8	2 1/16
1/2	1800	56C		8 3/4	6 1/8	5 3/8	2 1/16
1/3	3600	56C		8 1/2	6 1/8	5 3/8	2 1/16
1/2	3600	56C		8 3/4	6 1/8	5 3/8	2 1/16
3/4	3600	56C		9 1/4	6 1/8	5 3/8	2 1/16
1	3600	56C		9 3/4	6 1/8	5 3/8	2 1/16
1 1/2	3600	56C		10 1/2	7 3/16	6 7/8	2 1/4
2	3600	56C		11 1/8	7 3/16	6 7/8	2 1/4
3	3600	56C		12 3/8	7 3/16	6 7/8	2 1/4
5	3600	184C		13 5/8	8 1/2	7 7/8	2 1/4

PUMP END DIMENSIONS

		C	DD	PW	X	Y	Z	J	SUCTION	DISCHG
CD100	CI	5 7/8	3 3/16	6 11/16	3 1/2	1 3/8	2 3/4	4 5/8	1 1/4	1"
CD150	CI	6 13/16	4 1/16	7 15/16	3 13/16	2 1/8	3 1/16	5 5/8	2"	1 1/2



Product Quick Search

PCL3519M

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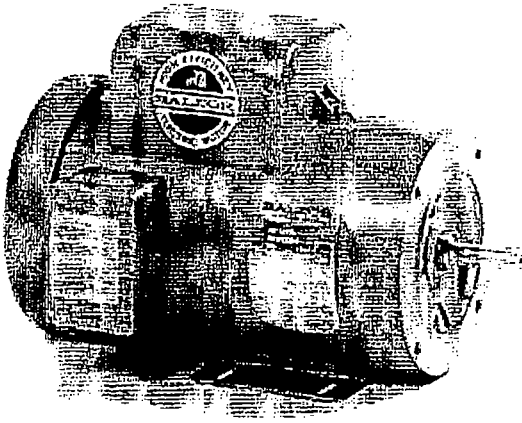
Catalog Number:	PCL3519M
Specification Number:	35K362Y870
Horsepower/Kilowatt:	3/2.24
Voltage:	230
Hertz:	60
Phase:	1
Full Load Amps:	12.5
Usable at 208 Volts:	NO
RPM:	3450
Frame Size:	56C
Service Factor:	1.15
Rating:	40C AMB-CONT
Locked Rotor Code:	F
NEMA Design Code:	L
Insulation Class:	F
Full Load Efficiency:	85.5
Power Factor:	95
Enclosure:	TEFC
Baldor Type:	3532LC
DE Bearing:	6205
ODE Bearing:	6203
Electrical Specification Number:	35WGY870
Mechanical Specification Number:	n/a
Base:	RG
Mounting:	F1

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CD 150 BF-494-6A212-PED

Price[®] Pump Company *Serial # 31122*

Type CD/RC Installation, Operating and Maintenance Manual

Warning:

Before installing, repairing or performing maintenance on this pump, read these instructions completely.

Disconnect power to pump before servicing to avoid dangerous or fatal electrical shock.

Match supply voltage to motor nameplate voltage. Incorrect voltage can cause fire or serious motor damage and void warranty.

Ground motor before connection to electrical power supply!! Failure to ground motor can cause severe or fatal electrical shock!!

Do not ground to gas supply line!!

Before disassembling pump, be certain all liquid is removed. If pump was used to move hazardous or toxic materials, it must be decontaminated prior to disassembly.

Close Coupled Motor Pumps:

It is suggested that these pumps be firmly bolted to a level surface. Adequate air movement around motor will help prevent overheating.

Do not over tighten inlet and outlet piping or volute may fracture.

Power Frame Mounted Pumps

These pumps must be mounted on a rigid steel base that will not warp or flex. Each pump must be mounted such that the pump shaft centerline is on center with the driver shaft centerline. Pad and/or shims will be required on either pump, driver or both. The two shafts should not touch each other and the distance between them depends on the coupling used to connect them.

Misalignment will cause vibration, bearing failure and void warranty. Pumps are rough aligned at the factory but must be realigned after shipment and installation.

Pulley driven pump must have pulleys inline and good belt tightness practices followed.

Direction of Rotation

Note: Motor shaft rotation is viewed from the suction end of pump. A rotational arrow is shown on the front of the pump volute casing. Incorrect rotation can cause pump damage, failure or reduced performance, voiding warranty. It is best to check rotation by momentarily energizing or jogging the motor prior to filling pump with liquid.

Warning! Do not operate pump without liquid for more than a few seconds, as damage will result to mechanical seal

Plumbing

All piping should be supported independently of the pump. Piping should not exert any stress on the pump connections.

PRICE® PUMP COMPANY

Suction Piping

(Horizontal Pumps)

Suction line must provide adequate suction pressure and smooth liquid flow for proper pump operation. Air in the suction line due to leaks or improper piping design may cause the pump to lose prime. Non-priming pumps must have their suction flooded at start up. Also, the suction line must provide sufficient pressure (NPSH) and smooth flow to pump inlet to prevent pump cavitation. The suction pipe length entering the pump should be a minimum of 5 times and preferably 10 times the pump inlet diameter. Elbows, fittings or valves installed close to the pump inlet can disrupt liquid flow and cause mal-function. Suction lines must be at least the same diameter as the pump inlet or larger if possible.

Price Pump Company recommends against using foot valves in the suction line to maintain liquid in the pump when it's not operating. If foot valves are used, due to suction lift conditions, they must be properly maintained to avoid leaks resulting from wear or fouling. Suction

piping must be designed to prevent vapor from being trapped in high spots in the piping. This condition may cause the pump to vapor lock.

Discharge Piping

To control flow and discharge head, it is advisable to install a valve (globe, ball, or other adjustable and non-leak type) in the discharge line close to the pump. The valve may be closed during system repairs to prevent backflow. By installing a check valve in the discharge line backflow can also be prevented during maintenance or during periods of pump stoppage.

Operation

All centrifugal pumps must be filled with liquid prior to start up. It is suggested that during initial start up the discharge valve be closed and then opened as the motor develops full rpm's. If pump does not build up pressure as motor speed increases, shut down and make sure that liquid flow into pump is not restricted (see "Troubleshooting").

Note: A centrifugal pumps flow and head (pressure) will vary with the amount of resistance (friction and flow restrictions) in the discharge line. As a valve on the discharge line opens the flow and motor amp draw will increase and head (pressure) will drop. As a valve on the discharge is closed the flow and amp draw will decrease and the head will increase.

If resistance in the discharge line is not sufficient the pump will operate at a condition of maximum flow, also sometimes called "end of performance curve." Maximum horse-power is required to operate at this point and motor overload may result. If excessive amp draw and motor overload is re-curring, reduce the system flow by installing a valve or orifice in the discharge line and restrict flow. Alternatively, reduce pump head by trimming impeller to a smaller diameter.

Consult local Price Pump distributor for assistance.

PRICE® PUMP COMPANY

Suction Piping

(Horizontal Pumps)

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Consult local Price Pump distributor for assistance.

TYPE CD/RC MAINTENANCE AND REPAIR

- | | | |
|--|---|---|
| <p>Tighten securely (10ft.lbs.) Caution: Serviceable Loctite must be used on lockdown bolt. Lockwasher pairs must be assembled cam face to cam face. See diagram</p> <p>g. Loosen pump shaft set screw.</p> <p>h. Install new volute gasket/o-ring and mount volute to bracket. Secure with bolts and tighten evenly.</p> <p>i. Setting impeller clearance: Slide pump shaft forward until impeller touches volute. Slide shaft back .010-.015". Tighten pump shaft set screws. Turn shaft by hand to ensure impeller does not rub against volute. Proceed to step 9.</p> <p>5. For Type 21, 8, 9 seals: Place the bracket on a firm surface with the seat cavity (pump end) up. Then place a small amount of vegetable oil on the seat cup or o-ring seat. Place the seat</p> | <p>in the seat cavity with the polished face up toward the pump end. Evenly push seat into cavity with fingers then gently tap seat into place with a wooden dowel or plastic rod (1-1/8" outside diameter). To help ensure the seat is not damaged place the cardboard disk supplied with the seal over the seat face.</p> <p>6. Place bracket on motor (aligning the base if applicable). Secure bracket with four motor bolts.</p> <p>7. Pull pump shaft forward until shoulder of pump shaft contacts back of bracket and slightly snug one setscrew to hold shaft in place</p> <p>8. Install seal head assembly</p> <p>For Type 21 Seals:</p> <p>a. Lubricate shaft and elastomer with vegetable oil.</p> <p>b. Install rotary seal head onto pump shaft</p> | <p>and slide toward seat until carbon face contacts ceramic seat.</p> <p>c. Install seal spring and retainer.</p> <p>d. Install impeller. Install key in pump shaft. Slide impeller onto shaft ensuring that the spring retainer does not slip between the shoulder of the shaft and the hub of the impeller. Install impeller flatwasher, lockwashers and lockdown. Tighten securely (10 ft. lbs.) Caution: Serviceable Loctite must be used on lockdown bolt. Lockwasher pairs must be assembled cam face to cam face. See diagram</p> <p>e. Loosen pump shaft set screw.</p> <p>f. Install new volute gasket/o-ring and mount volute to bracket. Secure with bolts and tighten evenly.</p> <p>g. Slide pump shaft forward until impeller touches volute. Slide shaft back with a screwdriver .010-</p> |
|--|---|---|

TYPE CD/RC MAINTENANCE AND REPAIR

-
- | | | |
|--|---|--|
| <p>.015". Tighten pump shaft set screws. Turn shaft by hand to ensure impeller does not rub against volute. Proceed to step 9.</p> <p>For Type 8 & 9 Seals:</p> <p>a. Install impeller. Install key in pump shaft. Slide impeller onto shaft and install impeller washer and lockdown bolt. Tighten securely.</p> <p>b. Loosen pump shaft set screw.</p> <p>c. Install new volute gasket/o-ring and mount volute to bracket. Tighten at least two bolts at this time.</p> <p>d. Slide pump shaft forward until impeller touches volute. Slide shaft back .010"-.015". Tighten pump shaft set screws. Turn shaft by hand to ensure impeller does not rub against volute.</p> <p>d. Remove volute and impeller.</p> <p>e. Install seal head onto pump shaft sliding gently past shoulder of shaft. Slide seal head toward seat</p> | <p>until carbon face contacts ceramic seat. Tighten seal head setscrews to pump shaft. Remove clips in seal head and discard.</p> <p>j. Reinstall impeller, flatwasher, lockwashers and lockdown bolt. Tighten securely (10 ft. lbs.) Caution: Serviceable Loctite must be used on lockdown bolt. Lockwasher pairs must be assembled cam face to cam face. See diagram</p> <p>k. Install new volute gasket and mount volute to bracket. Secure with bolts and tighten evenly.</p> <p>l. Rotate pump shaft by hand to ensure impeller does not rub against volute.</p> <p>9. Return pump to installation, reconnect electric connections.</p> <p>10. Start pump momentarily to observe shaft rotation. If rotation corresponds to the rotation arrow, pump</p> | <p>may be put into service. If rotation is incorrect, switch any two leads on 3-phase motors. Check wiring diagram of motor for single phase rotation.</p> <p>11. Remove top pipe plug (if applicable) from the front of volute and prime pump thoroughly, making sure all air is purged.</p> <p>12. Start pump allowing adequate time to purge all air from system. Observe any gauges, flow meters, etc. to see if pump performs properly.</p> |
|--|---|--|
-

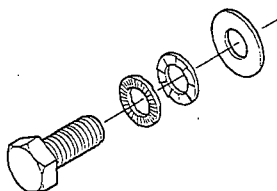
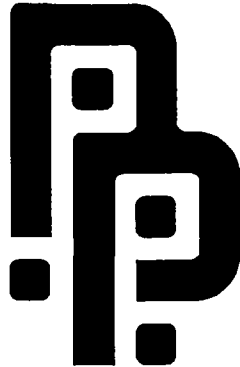


DIAGRAM A
LOCKDOWN
ASSEMBLY



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AC & DC Motor Installation – Maintenance Instructions

These instructions are intended to complement (not replace) the information in MN400 Installation and Operation manual for "Integral Horsepower AC Induction Motors ODP, TEFC, Explosion Proof" and MN605 Installation and Operation manual for "Integral Horsepower DC Motors".

Handling

The weight of the motor and shipping container will vary. Use correct material handling equipment to avoid injury.

Use caution when removing the motor from its packaging. Sharp corners may exist on motor shaft, motor key, sheet metal and other surfaces.

Receiving

Inspect the motor for damage before accepting it. The Motor shaft should rotate freely with no rubs. Report any damage immediately to the commercial carrier that delivered your motor.

Safety Notice

Only qualified personnel trained in the safe installation and operation of this equipment should install this motor. When improperly installed or used, rotating equipment can cause serious or fatal injury. Equipment must be installed in accordance with the National Electrical Code (NEC), local codes and NEMA MG2 Safety Standards for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators. Observe the following guidelines:

1. When eyebolts are provided, they must be fully tightened and are intended to lift the motor and its included accessories only.
2. Ground the motor according to NEC and local codes.
3. Provide a permanent guard to prevent accidental contact of body parts or clothing with rotating or moving parts or burns if motor is hot.
4. Shaft key must be secured before starting motor.
5. Do not apply power to the motor until the motor is securely mounted by its mounting holes.
6. This motor must only be connected to the proper line voltage, line frequency and load size.
7. Motors are not to be used for load holding or restraining unless a properly sized brake is installed. If a motor mounted brake is installed, provide proper safeguards for personnel in case of brake failure.
8. Disconnect all power services, stop the motor and allow it to cool before servicing.
9. For single phase motors, discharge the start and/or run capacitors before servicing.
10. Do not by-pass or render inoperative any safety device.
11. DC series wound motors must be protected from sudden loss of load causing overspeed damage. DC shunt wound motors must be protected from loss of field voltage which can result in damage.
12. When using AC motors with frequency inverters, be certain that the motors Maximum Speed Rating is not exceeded.
13. Mounting bolts should be high tensile steel. Be sure to use a suitable locking device on each bolt (spring washer or thread lock compound).

Guarding

After motor installation is complete, a guard of suitable dimensions must be constructed and installed around the motor/gearmotor.

This guard must prevent personnel from coming in contact with any moving parts of the motor or drive assembly but must allow sufficient cooling air to pass over the motor.

If a motor mounted brake is installed, provide proper safeguards for personnel in case of brake failure.

Brush inspection plates and electrical connection cover plates or lids, must be installed before operating the motor.

When this motor is installed according to these instructions, it complies with the EEC Machinery Directive. Electromagnetic Compatibility (EMC) requirements for CE compliance are met when the incoming power is purely sinusoidal. For other power source types, refer to MN1383 "Recommended Practices for Installation for EC Directive 89/336/EEC Relating to EMC".

BALDOR
MOTORS AND DRIVES

2/03

P.O. Box 2400
Fort Smith, AR 72902-2400 U.S.A.
(479) 646-4711

LD0040

Motor Enclosure

ODP, Open drip proof motors are intended for use in clean, dry locations with adequate supply of cooling air. These motors should not be used in the presence of flammable or combustible materials. Open motors can emit flame and/or molten metal in the event of insulation failure.

TEFC, totally enclosed motors are intended for use where moisture, dirt and/or corrosive materials are present in indoor and outdoor locations.

Explosion proof motors, as indicated by the Underwriters Laboratories, Inc. label are intended for use in hazardous areas as specified by the NEC.

Mounting

Foot mounted machines should be mounted to a rigid foundation to prevent excessive vibration. Shims may be used if location is uneven.

Flange mounted machines should be properly seated and aligned. Note: If improper rotation direction is detrimental to the load, check rotation direction prior to coupling the load to the motor shaft.

For V-belt drive, mount the sheave pulley close to the motor housing. Allow clearance for end to end movement of the motor shaft. Do not overtighten belts as this may cause premature bearing failure or shaft breakage.

Direct coupled machines should be carefully aligned and the shaft should rotate freely without binding.

Wiring

Connect the motor as shown in the connection diagram. If this motor is installed as part of a motor control drive system, connect and protect the motor according to the control manufacturers diagrams. The wiring, fusing and grounding must comply with the National Electrical Code and local codes. When the motor is connected to the load for proper direction of rotation and started, it should start quickly and run smoothly. If not, stop the motor immediately and determine the cause. Possible causes are: low voltage at the motor, motor connections are not correct or the load is too heavy. Check the motor current after a few minutes of operation and compare the measured current with the nameplate rating.

Adjustment

The neutral is adjustable on some DC motors. AC motors have no adjustable parts.

Noise

For specific sound power or pressure level information, contact your local Baldor representative.

Vibration

This motor is balanced to NEMA MG1, Part 7 standard.

Brushes (DC Motors)

Periodically, the brushes should be inspected and all brush dust blown out of the motor. If a brush is worn $1/2$ " (from length specified in renewal parts data), replace the brushes. If the commutator is worn or rough, the armature should be removed. The commutator should be turned in a lathe, the mica recut and the commutator polished. Reassemble and seat the new brushes using a brush seating stone. Be sure the rocker arm is set on the neutral mark.

Lubrication

This is a ball or roller bearing motor. The bearings have been lubricated at the factory. Motors that do not have regrease capability are factory lubricated for the normal life of the bearings.

Lubricant

Baldor motors are pregreased, normally with Polyrex EM (Exxon Mobil). If other greases are preferred, check with a local Baldor Service Center for recommendations.

Relubrication Intervals (For motors with regrease capability)

New motors that have been stored for a year or more should be relubricated. Lubrication is also recommended at these intervals:

Table 1 Relubrication Interval

NEMA (IEC) Frame Size	Rated Speed (RPM)			
	3600	1800	1200	900
Up to 210 incl. (132)	5500Hrs.	12000Hrs.	18000Hrs.	22000Hrs.
Over 210 to 280 incl. (180)	3600Hrs.	9500Hrs.	15000Hrs.	18000Hrs.
Over 280 to 360 incl. (225)	*2200Hrs.	7400Hrs.	12000Hrs.	15000Hrs.
Over 360 to 5000 incl. (300)	*2200Hrs.	3500Hrs.	7400Hrs.	10500Hrs.

* Lubrication interval for 6313 or 6314 bearings that are used in 360 through 5000 frame, 2 pole motors. If roller bearings are used, bearings must be lubricated more frequently, divide the relubrication interval by 2

Table 2 Service Conditions

Severity of Service	Ambient Temperature Maximum	Atmospheric Contamination	Type of Bearing
Standard	40° C	Clean, Little Corrosion	Deep Groove Ball Bearing
Severe	50° C	Moderate dirt, Corrosion	Ball Thrust, Roller
Extreme	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion	All Bearings
Low Temperature	<-30° C**		

* Special high temperature grease is recommended.

** Special low temperature grease is recommended.

Table 3 Lubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Table 4 Amount of Grease to Add

Frame Size NEMA (IEC)	Bearing Description (Largest bearing in each frame size)					
	Bearing	OD D mm	Width B mm	Weight of grease to add ounce (gram)	Volume of grease to add inches ³	teaspoon
Up to 210 incl. (132)	6307	80	21	0.30 (8.4)	0.6	3.0
Over 210 to 280 incl. (180)	6311	120	29	0.61 (17.4)	1.2	3.9
Over 280 to 360 incl. (225)	6313	140	33	0.81 (23.1)	1.5	5.2
Over 360 to 5000 incl. (300)	NU322	240	50	2.12 (60.0)	4.1	13.4

Weight in grams = 0.005 DB

Procedure

Clean the fitting (or round grease hole, if equipped with slotted grease screws). If motor has grease plug, remove it. Motors can be regreased while stopped (at less than 80°C) or running.

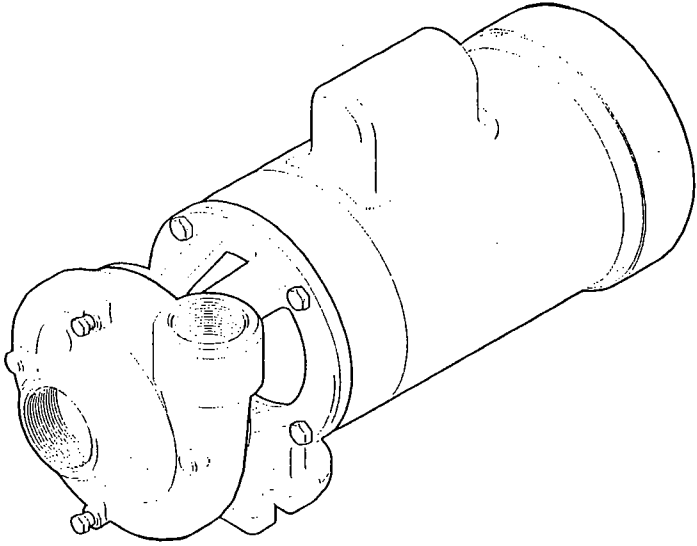
Apply grease gun to fitting (or grease hole). Too much grease or injecting grease too quickly can cause premature bearing failure. Slowly apply the recommended amount of grease, taking 1 minute or so to apply. Operate motor for 20 minutes, reinstall purge plug if previously removed. Caution: Keep grease clean. Mixing dissimilar grease is not recommended.

Sample Relubrication Determination

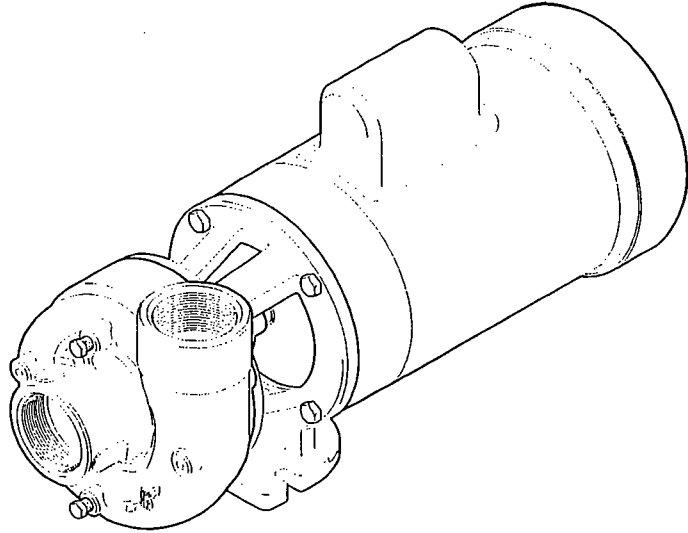
This sample determination is based on a NEMA 286T (IEC 180) motor operating at 1750 RPM driving an exhaust fan in an ambient of 43°C atmosphere that is moderately corrosive.

- Table 1 list 9500 hours for standard conditions.
- Table 2 classifies severity of service as "Severe".
- Table 3 lists a multiplier value of 0.5 for Severe conditions.
- Table 4 shows that 1.2 in³ or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

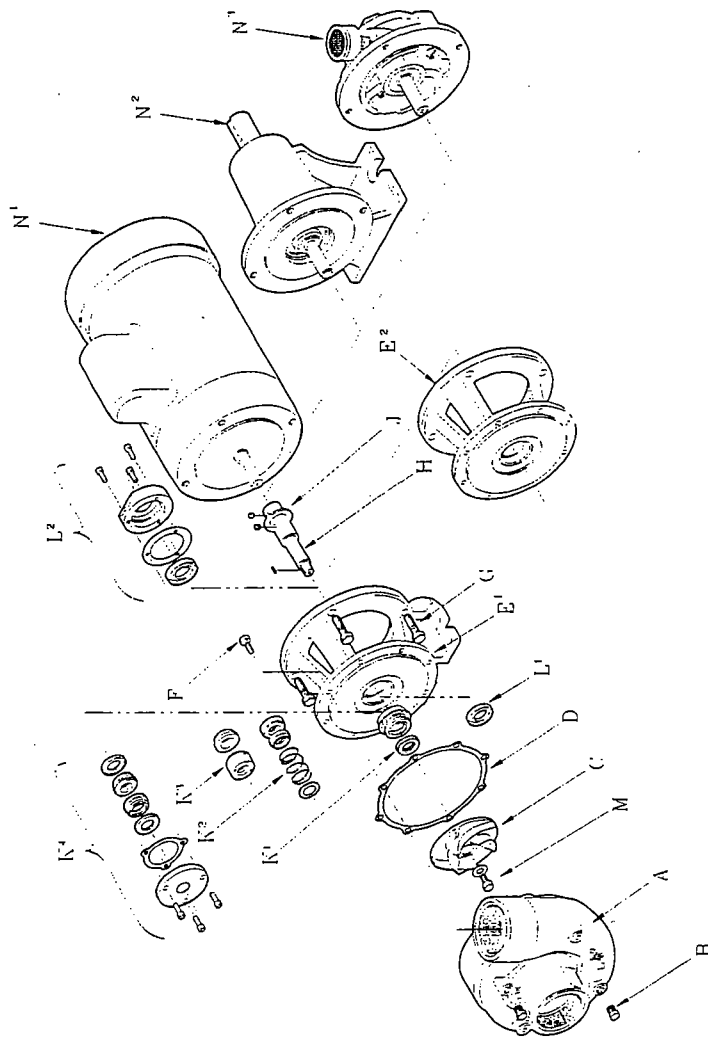


TYPE CD



TYPE RC

TYPE RC PARTS LIST



INSTRUCTIONS FOR DOUBLE SEAL INSTALLATION

Type 21 JM Style

Type 21 C Face Style

Installation of Double Seal Piping

Double Seal pumps are generally used for one of these reasons:

1. To avoid seal damage when pumping abrasives.
2. To cool seal when pumping hot liquids.
3. To prevent pumpage from leaking to atmosphere when pumping toxic or other dangerous liquids.

A double seal must have pressure to the seal chamber at a minimum of 5 PSI preferable 10 PSI above pump pressure.

Flows through seal chamber will depend upon pumpage temperature. Minimum flow should be 1 GPM for CD100 and CD150 and at least 2 GPM for the Type X and JB series double seal. Flows may have to be increased with higher temperatures. Check the seal chamber discharge to be sure water is below boiling. We suggest 140 to 150 degrees temperature. If seal water flashes, seal may be damaged. Inlet water should become in at bottom and out at top to avoid an air pocket in chamber. Be sure to prime the secondary pumping system properly as you would any other system.

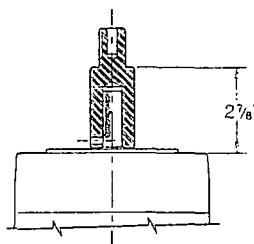
CAUTION: Always Pressurize the Seal Chamber before starting the main pump!

In a pumping system that starts and stops automatically, be sure that both pumps start at the same time.

Type 21 JM Style Double Seal Installation (For Type XJ/JB Series Pumps)

REASSEMBLY

1. Clean pump and motor shaft thoroughly.
2. Assure that the shaft is not grooved and that there is no evidence of pitting or fretting. If the shaft is grooved, fretted or worn, replace it.
3. On 56C motors, (stub shaft pumps only), ensure all debris and burrs are removed from the motor shaft. Align halfdog setscrew with motor keyway while sliding stub shaft over the motor shaft. Set height (diagram A). Tighten all set screws



4. On JM style motors, apply Loctite RC/609 to inside diameter of shaft sleeve. Install shaft sleeve onto motor shaft making sure that the groove for the PTFE sleeve gasket is facing the pump end. Clean excess Loctite from shaft. Be sure sleeve is seated against motor shaft shoulder.
5. Place a small amount of vegetable oil on the seat cup or "O" ring seat. Install seats into seat plates with polished faces up. Evenly push seat into seat cavity

- with fingers, then gently tap seat into place with a wooden dowel or plastic pipe (2" outside diameter). To help ensure the seat is not damaged, place the cardboard disk supplied with the seal under the end of the dowel to prevent damaging the seat face.
6. Install first seal plate onto rear of bracket with new gasket and tighten three allen capscrews evenly (note: use PTFE pipe sealant on gasket surface and bolts).
7. Place bracket on motor (aligning the base if applicable). Secure bracket to motor with four motor bolts and washers.
8. Install seal head assembly:
For Type 21:
 - a. Lubricate shaft and elastomer with vegetable oil.
 - b. Install first rotary seal head onto pump shaft and slide toward seat using a twisting motion until carbon face touches seal seat.
 - c. Install seal spring over shaft sleeve.
 - d. Install second rotary seal head onto shaft sleeve with carbon facing towards pump end.
9. Install second seal plate onto pump end of bracket with new gasket and tighten three allen capscrews evenly (note: use PTFE pipe sealant on gasket surface and bolts).
11. Install impeller onto motor shaft being careful to align keyway of impeller with keyway in motor shaft. Push impeller on until impeller bottoms out on shaft sleeve.
12. Install impeller lockdown gasket and impeller lockdown. Tighten securely.
13. Install new volute gasket. Make sure that all of the mating surfaces of the gasket joint are cleaned to bare metal.
14. Install volute and secure with 8 bolts and tighten evenly.
15. Rotate pump shaft by hand to make sure impeller does not rub against volute.
16. Return pump to installation, reconnect electric connections.
17. Start pump momentarily to observe shaft rotation. If rotation corresponds to the rotation arrow on the pump, it may be put into service. If rotation is incorrect, switch any two leads on 3-phase motors to change rotation. Check wiring diagram of motor for single phase rotation correction.
18. Remove top pipe plug (if applicable) from the front of volute and prime pump thoroughly, making sure all air is purged. Turn shaft one revolution and then refill. Replace the pipe plug.
19. Start pump allowing adequate time to purge all air from system. Observe any gauges, flow meters, etc., to see if pump performs properly.

Type 21 C Face Style Double Seal Installation

(For Type CD, RC, LT, & MS Series Pumps)

REASSEMBLY		
1. Clean seat cavity of the bracket and seal plate thoroughly.	then gently tap seat into place with a wooden dowel or plastic rod (1-1/8" outside diameter). To help ensure the seat is not damaged, place the cardboard disk supplied with the seal under the end of the dowel to prevent damaging the seat face.	11. Install new volute gasket, or O-ring and mount volute. Secure with bolts and tighten evenly.
2. Thoroughly clean pump shaft. Assure that the shaft is not grooved and that there is no evidence of pitting or fretting. Polish the shaft with extra fine emery cloth and clean the keyway. If the shaft is grooved, fretted or worn, replace it.	7. Install seal head assembly:	12. Move shaft back with a screwdriver .010-.015". Tighten pump shaft set screws. Turn shaft by hand to ensure impeller does not rub against volute.
	For Type 21:	13. Return pump to installation, reconnect electric connections.
3. Install the pump shaft onto the motor shaft, aligning set screws of the pump shaft with the keyway of the motor shaft. Ensure all debris and burrs are removed from the motor shaft and that the slinger is in place.	a. Lubricate shaft and elastomer with vegetable oil. b. Install first rotary seal head onto pump shaft and slide toward seat using a twisting motion until carbon face touches seal seat. c. Install second rotary seal head onto shaft sleeve with carbon facing towards pump end.	14. Start pump momentarily to observe shaft rotation. If rotation corresponds to the rotation arrow on the pump, it may be put into service. If rotation is incorrect, switch any two leads on 3-phase motors to change rotation. Check wiring diagram of motor for single phase rotation correction.
4. Place bracket on motor (aligning the base if applicable). Secure bracket with four motor bolts.	8. Install seal plate onto pump end of bracket with new gasket and tighten three allen capscrews evenly (note: use PTFE pipe sealant on bolts).	15. Remove top pipe plug (if applicable) from the front of volute and prime pump thoroughly, making sure all air is purged. Turn shaft one revolution and then refill. Replace the pipe plug.
5. Pull out pump shaft as far as it will go toward volute end and slightly snug one set screw to hold shaft in place	9. Install impeller:	16. Start pump allowing adequate time to purge all air from system. Observe any gauges, flow meters, etc., to see if pump performs properly.
6. Place a small amount of vegetable oil on the seat cup. Install seats into seat plate and bracket with polished faces up. Evenly push seat into seat cavity with fingers,	a. Install key in pump shaft. b. Slide impeller onto shaft. c. Install impeller washer and lockdown. Tighten.	
	10. Loosen pump shaft set	

	<u>RC200</u>	<u>RC300</u>		<u>RC200</u>	<u>RC300</u>
A. Volute	0183	0120	L. T. 6A Quench lip seal, Viton®	0899	0899
B. Pipe plug	0557	0557	M. Impeller lockdown bolt	0575	0575
C. Impeller (specify diameter)			N. Impeller lockdown washer	2423	2423
All iron	4184-dia.	4230-dia.	P. Impeller lockwasher (2 req.)	2344	2344
Bronze fitted	4128-dia.	4119-dia.	Q. Impeller key	2424	2424
D. Gasket (volute flange)	0506	0506	R ₁ . Motor - specify P/N		
E ₁ . Bracket with foot	2426	2426	R ₂ . Power Frame		
E ₂ . Bracket without foot	2428	2428	For use w/ 5/8" shaft	5478	5478
F. Volute bolts (8 req.)	0573	0573	For use w/ 7/8" shaft	5501	5501
G. Motor bolts (4 req.)	0588	0588	R ₃ . Air motor - specify P/N		
H. Shaft w/ setscrews 5/8" I.D.	2421-1	2421-1			
Shaft w/ setscrews 7/8" I.D.	2422-1	2422-1			
J. Slinger	0522	0522			
<u>Seal/seal</u>					
K ₁ . T. 6A Buna, carbon vs ceramic	0538	0538	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;"><u>RC Repair Parts Kit</u></p> <p>Repair Kit f/ 5/8" keyed shaft P/N 2204</p> <p>Repair Kit f/ 7/8" keyed shaft P/N 2204-1</p> <p>Kit includes: Gasket (volute flange), pump shaft w/setscrews, slinger, impeller lockdown and key</p> <p>Note: Seal/seal must be ordered in addition to kit</p> </div>		
K ₂ . T. 21 Viton®, carbon vs ceramic	0553	0553			
K ₃ . T. 9 Teflon®, carbon vs ceramic	1150	1150			
K ₄ . Double seal arrangement					
T. 21 Viton®, carbon vs ceramic	0985	0985			
T. 21 Neoprene, carbon vs ceramic	0984	0984			
T. 21 EPR, carbon vs ceramic	1023	1023			
Double seal plate	0973	0973			
Seal plate gasket, Teflon®	0974	0974			
Seal plate bolts (3 req.)	0256	0256			

DOUBLE SEAL PIPING INSTALLATION INSTRUCTIONS

Double Seal Flush Piping Installation

- Piping of the double seal arrangement should be done in accordance with all governmental regulations and safety codes.
- All double seals require a barrier flush between the seals for proper lubrication and cooling. The barrier liquid must be maintained at 10-15 PSIG above the discharge pressure of the pump and it must be chemically compatible with the pumped liquid, material construction of the pump, and seals (5/8" double seals have 18-8 parts).
- The barrier flush shall have a minimum flow rate in accordance with the graph below. If water is used as a fluid, the inlet temperature should not exceed 140° F.
- A positive pressure must be maintained to the barrier flush between the seal faces even when the pump is not running. To conserve the barrier liquid a solenoid valve (Item 1) may be installed and connected electrically in parallel with the motor so the barrier fluid flows only when the pump is running. Note: The maximum pressure of the barrier fluid at the inlet is 150 PSIG.
- The inlet should be connected to the bottom and the outlet to the top of the seal cavity.

Procedures For Checking Double Seals for Internal Leakage

Option 1

(for use with 2 flow meters)

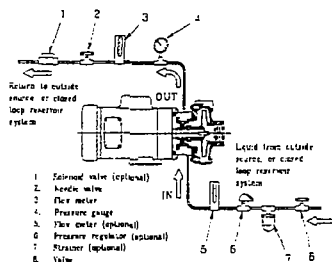
Install flow meters on the inlet and outlet lines. Normal operating conditions will be indicated by equal or near equal flow on both flow meters. If the inlet flow meter shows more flow than the outlet, this could indicate excessive leakage.

Option 2

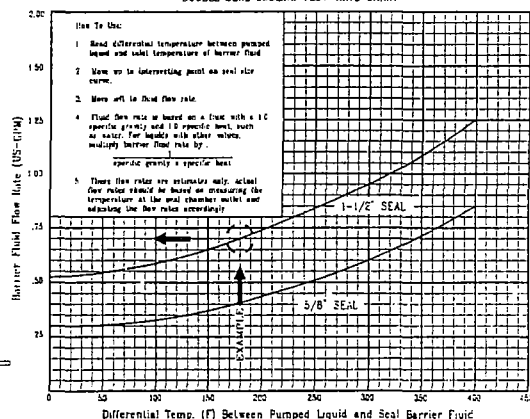
(for use with 1 flow meter)

- Shut off flow at outlet needle valve (Item 2).
- Shut off inlet gate valve (Item 8) - for 15 seconds maximum.

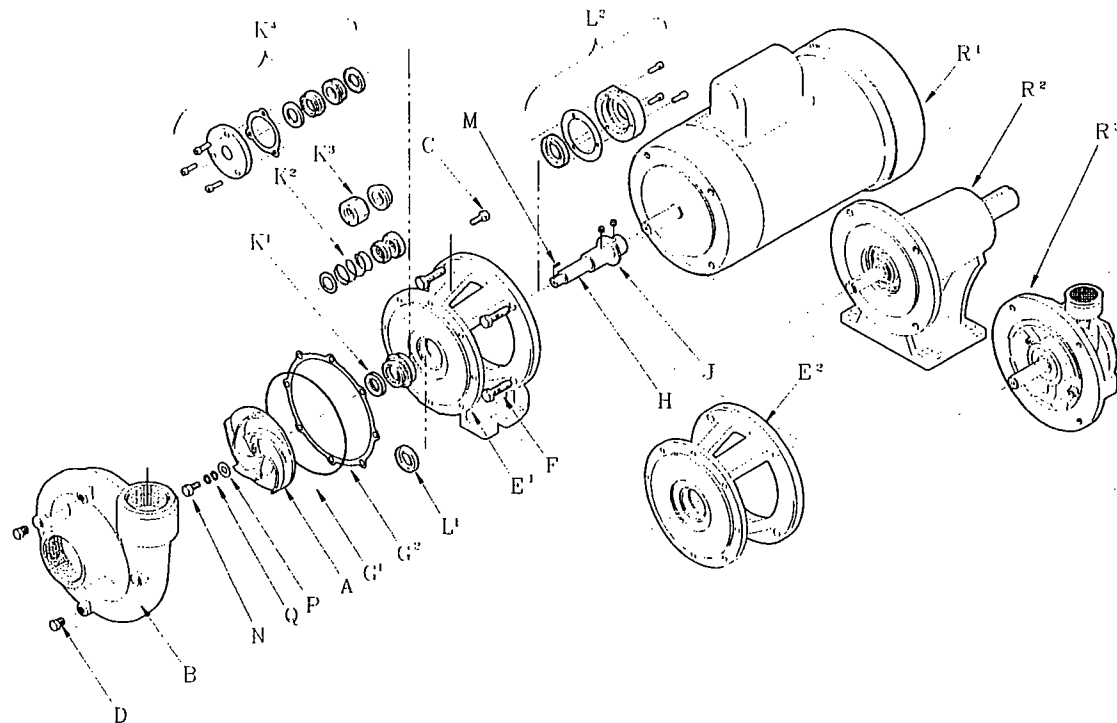
- If pressure in seal cavity drops rapidly rather than gradually while the gate valve is shut, the seal is leaking excessively.
- To restart open gate valve first then reset valve on outlet.



DOUBLE SEAL COOLING FLOW RATE CHART



TYPE CD (AI, BF, & AB) PARTS LIST



	<u>CD100AI</u>	<u>CD100BF</u>	<u>*CD100AB</u>	<u>*CD150AI</u>	<u>*CD150BF</u>	<u>*CD150AB</u>	
A. Impeller / specify diameter	2402-dia.	2404-dia.	2404-dia	2408-dia.	2410-dia	2410-dia.	
B. Volute	2401	2401	2403-0	2407-0	2407-0	2409-0	
C. Volute bolt	0573 (4 req)	0573 (4 req)	0376 (4 req)	0573 (8 req.)	0573 (8 req)	0376 (req)	
D. Pipe plug	0557	0557	0558	0557	0557	0558	
E ¹ . Bracket with foot	2426	2426	2400	2426	2426	2400	
E ² . Bracket without foot	2428	2428	2440	2428	2428	2440	
F. Motor bolt (4 req.)	0588	0588	0592	0588	0588	0592	
G ¹ . O-Ring volute gasket							* These
Buna (standard)	n/a	n/a	3074	3074	3074	3074	Models Use
Fluorocarbon	n/a	n/a	3070	3070	3070	3070	An O-Ring
PTFE	n/a	n/a	3071	3071	3071	3071	Volute Flange
Neoprene	n/a	n/a	3072	3072	3072	3072	Gasket (G ¹)
EPR	n/a	n/a	3073	3073	3073	3073	
G ² . Gasket, fiber	0506	0506	n/a	n/a	n/a	n/a	
J.	<u>Part No. All Models</u>				<u>Part No. All Models</u>		
H. Shaft 5/8" I.D.	2421-1		N. Impeller lockdown		0575		
Shaft 7/8" I.D.	2422-1		P. Impeller flatwasher		2423		
I. Slinger	0522		Q. Impeller lockwashers		2344		
<u>Seal/Seat</u>			R ¹ . Motor - specify part number				
K ¹ . T6A Buna (standard)	0538		R ² . Power Frame				
T6A Fluorocarbon	0539		For use with 5/8" I.D. shafts		5478		
K ² . T21 Fluorocarbon	0553		For use with 7/8" I.D. shafts		5501		
K ³ . T9 PTFE	1150		R ³ . Air motor - specify part number				
K ⁴ . Double seal/seat							
T21 Fluorocarbon	0985 (2ea. required)						
T21 Neoprene	0984						
T21 EPR	1023						
Double seal plate	0973						
Gasket PTFE	0974						
Bolt	0977 (3ea. required)						
L ¹ . T6A. quench lip seal Fluorocarbon	0899						
L ² . T.21 quench opt. (for 5/8" shaft pumps only)							
Quench Plate	0308						
Plate Gasket, Syn. Fiber	0504						
Plate Bolts (3 req.)	0267						
Fluorocarbon Lip Seal	0891						
M. Impeller key	2424						

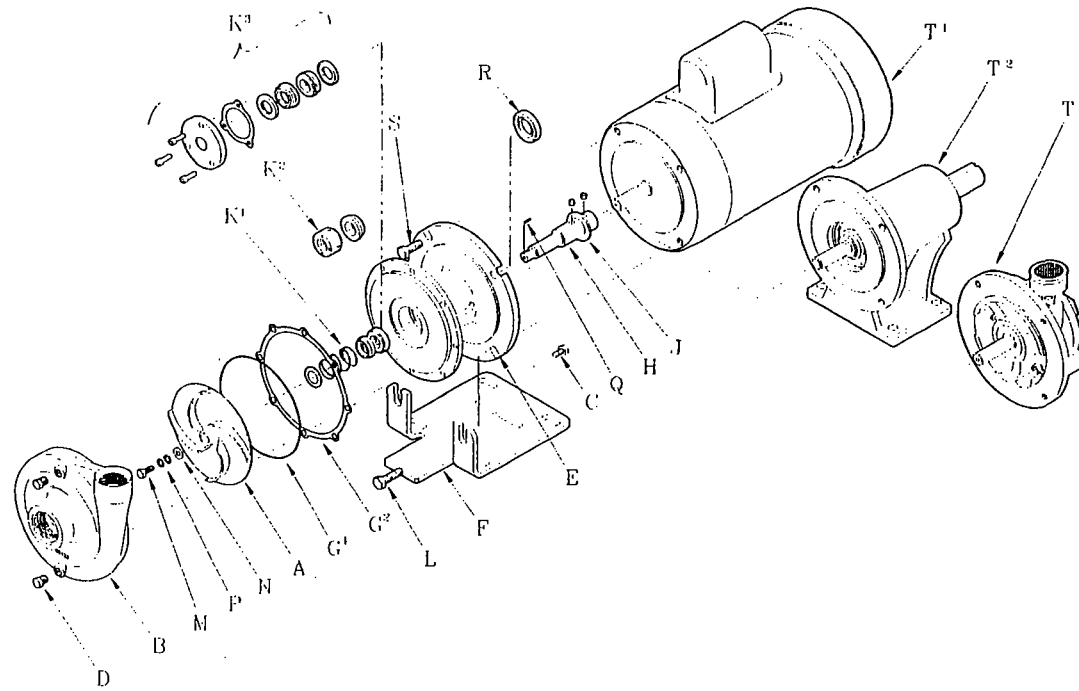
CD (AI, BF, AB) Repair Parts Kit

P/N 2222 Includes: 5/8" Shaft , Slinger, Impeller lockdown assy., and impeller key.

P/N 2222-1 Includes: 7/8" shaft, slinger, Impeller lockdown assy., and impeller key.

NOTE: Must order Gasket or O-ring and Seal/Seat separately.

TYPE CD SS PARTS LIST



CD100SS

- A. Impeller
 B. Volute
 C. Volute bolt (8 req.)
 D. Pipe plug
 E. Bracket
 F. Pump Base
 G₁. O-ring (for volute flange)

Fluorocarbon (std)
 Buna
 PTFE
 Neoprene
 EPR

- G₂. Gasket, PTFE (for CD100SS only)

- H. Shaft w/ setscrews 5/8" I.D.
 Shaft w/ setscrews 7/8" I.D.
 J. Slinger

Seal/seal

- K₁. T.21 Fluorocarbon
 K₂. T. 9 PTFE, carbon vs ceramic
 K₃. Double seal arrangement
 T. 21 Fluorocarbon, carbon vs ceramic
 T. 21 Neoprene, carbon vs ceramic
 T. 21 EPR, carbon vs ceramic

Double seal plate
 Seal plate gasket, PTFE

CD150SS

- 2448-dia. 2412-dia.
 0247 2411-0
 0917 0917
 0559 0559
 0972 0972
 0199 0199

- 3070 3070
 3074 3074
 3071 3071
 3072 3072
 3073 3073
 0507 N/A
 2421-1 2421-1
 2422-1 2422-1
 0522 0522

CD100SS CD150SS

- 0973 0973
 0974 0974

- Seal plate bolts (3 req.) 0256 0256
 L. Motor bolt 0673 0673
 M. Impeller lockdown bolt 0575 0575
 N. Impeller lockdown washer 2423 2423
 P. Impeller lockwasher (2 req.) 2344 2344
 Q. Impeller key 2424 2424
 R. Fluorocarbon Quench lip seal 0891 0891
 S. Motor bolt (2 req.) 0593 0593
 T₁. Motor - specify P/N
 T₂. Power Frame
 For use w/ 5/8" shaft 5478 5478
 For use w/ 7/8" shaft 5501 5501
 T₃. Air motor - specify P/N

CD (AI, BF, AB) Repair Parts Kit

P/N 2205 Includes: 5/8" Shaft , Slinger, Impeller lockdown assy., and impeller key.

P/N 2205-1 Includes: 7/8" shaft, slinger, Impeller lockdown assy., and impeller key.

NOTE: Must order Gasket or O-ring and Seal/Seat separately.

100

TROUBLESHOOTING

1. Pump fails to build pressure:

Check for:

- a. Pump not primed.
- b. Incorrect rotation.
- c. Driver speed too low.
- d. Suction line restricted.
- e. Driver failure.
- f. Plugged or damaged impeller.
- g. Pump or impeller undersized.
- h. Pump cavitation.
- i. Improper impeller clearance.

2. Pump fails to provide enough flow.

Check for:

- a. System resistance too high.
- b. Pump undersized.
- c. Pump not primed.
- d. Driver speed too low.
- e. Poor suction conditions.
- f. Improper impeller clearance.

3. Excessive noise or vibration during operation.

Check for:

- a. Motor bearing failing.
- b. Pump cavitating.
- c. Improper impeller clearance.

4. Leaking mechanical seal.

Check for:

- a. Improper assembly.
- b. Worn or cracked seal faces.
- c. Abrasive material in fluid.
- d. Liquid flashing at seal faces (fluid temperature too high).
- e. Seal pressure rating too low for the service.
- f. Chemical attack of seal parts.
- g. Seal operated dry or with a liquid having poor lubricating properties.

5. Pump gradually loses pressure and head.

Check for:

- a. Increasing temperature causing cavitation or liquid vaporization.
- b. Driver failure.
- c. Suction lift too high.
- d. Air entering suction line.

6. Motor/pump overheating.

Check for:

- a. Excessive flow and amp draw (Throttle discharge).
- b. Low voltage or frequency.
- c. Flow too low with resulting heat rise.
- d. Bearing failure.
- e. System temperature too high.

If all else fails, call your distributor or Price Pump @ (707) 938-8441



GENERAL TERMS OF SALE FOR PRODUCTS

Effective: January 2003

1. GENERAL

A. Seller's price is based on these order terms and conditions. The contract shall represent the final, complete, and exclusive statement of the agreement between Buyer and Seller. No other terms, conditions, or specifications shall be applicable to this contract. Any terms, conditions, or specifications that may be modified, supplemented, explained or varied by oral agreement, written or otherwise, shall be null and void. The terms and conditions contained in Buyer's purchase order or request for quotation, any source of delivery between the parties, Seller's performance or delivery, or in any other way. The Terms and Conditions of this contract may only be modified or amended in a written document signed by an authorized representative of Seller. These terms are intended to cover all activity of Seller and Buyer hereunder, including sales and use of products, parts and work and all related matters (reference to products include parts and references in work include construction, installation and start-up). Any reference by Seller to Buyer's specifications and similar requirements are only to describe the products and work covered hereby, and no warranties or other terms therein shall have any force of effect. Any information provided by Seller including, but not limited to, suggestions as to specific equipment does not imply any guarantee of specific suitability and/or material compatibility in a particular application, since many factors outside the control of Seller may affect the suitability of products in a particular application. Catalogs, circulars, similar pamphlets and information contained on websites of the Seller are issued for general information purposes only and shall not be deemed to modify the provisions hereof.

B. The agreement formed hereby, and the language herein shall be construed and enforced under the Uniform Commercial Code as in effect in the State of California on the date hereof.

2. TAXES

A. Any sales, use or other similar type taxes imposed on this sale or on this transaction are not included in the price. Such taxes shall be billed separately to the Buyer. Seller will accept a valid exemption certificate from the Buyer if it is applicable; however, if an exemption certificate previously accepted by Seller is not recognized by the governmental taxing authority involved and the Seller is not required to pay the tax covered by such exemption certificate, Buyer agrees to

3. PERFORMANCE, INSPECTION AND ACCEPTANCE

A. Upon Seller's final acceptance, installation, commissioning or start-up (whichever is applicable), all products shall be finally inspected and accepted within thirty (30) days after arrival at point of delivery. Products not covered by the foregoing and all work shall be finally inspected and accepted within thirty (30) days after completion of the applicable work by Seller. All claims whatsoever by Buyer, (including claims for limitations) except only those provided for under the WARRANTY AND LIMITATION OF LIABILITY OF PARTS AND PAINTS Clauses, hereof, must be asserted in writing by Buyer within said thirty (30) day period or they are waived. If this contract involves partial performance, all such claims must be asserted within said thirty (30) day period for each partial performance. There shall be no revocation of acceptance. Rejection may be only for defects substantially impairing the value of products or work and Buyer's remedy for lesser defects shall be those provided for under the WARRANTY AND LIMITATION OF LIABILITY Clause.

B. Seller shall not be responsible for non-performance or for delays in performance occasioned by any cause beyond Seller's reasonable control, including, but not limited to, labor difficulties, delays of vendors or carriers, fires, gas, criminal actions, or shortages of material, components, labor, or manufacturing facilities. Any delays so occasioned shall affect a scheduled completion date of the contract, but shall not constitute a breach of contract. The extension of Seller's performance shall be limited to the extent of the delay in completion of the contract, but shall not constitute a breach of contract. Seller reserves the right to make partial shipments and to ship goods, its parts or work which may be completed prior to the scheduled performance date.

C. In the event that Seller has agreed to manufacture, assemble, install, or otherwise products which are not manufactured by Seller and which are not an integral part of Seller's manufactured product, and a delay in the delivery of such products to Seller occurs that will cause a delay in Seller's performance date, Seller reserves the right to ship its product upon completion of manufacture and to refund an equitable portion of the amount originally included in the purchase price for measuring without incurring liability for non-performance.

D. Seller reserves to itself the right to change its specifications, drawings and standards if such changes will not impair the performance of its products and parts, and further that such products and parts, will meet any of Buyer's specifications and other specific product requirements which are a part of this agreement.

E. The manufacture and inspection of products and parts shall be in Seller's Engineering and Quality Assurance standards plus such other inspections or tests of documentation as are specifically agreed to by Seller. Requirements for any additional inspection, tests, documentation, or Buyer's witness of manufacture, test, and/or inspection shall be subject to additional charges.

4. TITLE AND RISK OF LOSS

Title and risk of loss shall pass to Buyer upon delivery of products at the designated "In Works" as defined by Incoterms 1990, unless otherwise agreed by the parties.

5. EROSION AND CORROSION

It is specifically understood that products and parts sold hereunder are not warranted for operation with erosive or corrosive fluids. No product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action of any fluid and Buyer shall have no claim whatsoever against Seller therefore.

6. BUYER'S RESPONSIBILITY

The design specifications of the equipment require the operation of the equipment within certain parameters and may call for the use of speed controls, safety devices, act points or other control devices to make that the equipment operates within design parameters. Buyer agrees and understands that the equipment may be operated and maintained within design specifications.

1. WARRANTY AND LIMITATION OF LIABILITY

A. Seller warrants only that its products and parts, when shipped, will be free from defects in materials and workmanship. With respect to products and parts not manufactured by Seller, Seller's only obligation shall be to design to that or, in the event possible, warrant or warranty. Seller requires that the manufacturer. All claims for defective products or parts under this warranty must be made in writing immediately upon discovery and, in any event, within one (1) year after initial start-up or eighteen (18) months after shipment, whichever first occurs, and all claims for defective work must be made in writing immediately upon discovery and, in any event, within one (1) year of completion thereof by Seller. Point of items must be held for Seller's inspection and returned to the Seller's point of original shipment upon request. UNAUTHORIZED DISASSEMBLY OR TAMPERING WITH ANY PRODUCT OR COMPONENT MAY VOID ITS WARRANTY. THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS.

B. ANY PRODUCT (S) SOLD HEREUNDER WHICH IS NOT

MANUFACTURED BY SELLER IS NOT WARRANTED BY SELLER and shall be covered only by the express warranty, if any, of the manufacturer thereof. C. Upon Buyer's submission of a claim as provided above and its substantiation, Seller shall at its option either (i) repair or replace to product, part or work at the original place of shipment, or (ii) refund an equitable portion of the purchase price.

D. THE FOREGOING IS SELLER'S ONLY OBLIGATION AND BUYERS EXCLUSIVE REMEDY FOR BREACH OF WARRANTY AND EXCEPT FOR REQUESTS FOR REPAIRS, REPLACEMENTS, REFUNDS, AND CREDITS, SELLER DOES NOT UNDERTAKE THE PATENT'S OBLIGATIONS, INSPECTION AND ACCEPTANCE AND THE PATENT'S CLAUSES HEREBY. THE FOREGOING IS BUYER'S EXCLUSIVE REMEDY AGAINST SELLER FOR ALL CLAIMS ARISING HEREUNDER OR RELATING HERETO WHETHER SUCH CLAIMS ARE BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHER THEORIES. BUYERS FAILURE TO SUBMIT A CLAIM AS PROVIDED ABOVE SHALL SPECIFICALLY WAIVE ALL CLAIMS FOR DAMAGES OR OTHER RELIEF, INCLUDING, BUT NOT LIMITED TO CLAIMS BASED ON LATENT DEFECTS, IN NO EVENT SHALL BUYER BE ENTITLED TO INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, NOR FOR DAMAGES FOR LOSS OF USE, LOST PROFITS OR REVENUE, INTEREST, LOST GOODWILL, WORK OR PRODUCTION STOPPAGE, IMPAIRMENT OF OTHER GOODS, INCREASED EXPENSES OF OPERATION, OR THE COST OF PURCHASING REPLACEMENT POWER OR OTHER SERVICES BECAUSE OF SERVICE INTERRUPTIONS. FURTHERMORE, IN NO EVENT SHALL SELLER'S TOTAL LIABILITY FOR DAMAGES OF BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCTS OR PARTS MANUFACTURED BY SELLER AND UPON WHICH SUCH LIABILITY IS BASED. ANY ACTION ARISING HEREUNDER RELATED HERETO, WHETHER BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHER THEORIES, MUST BE COMMENCED WITHIN ONE (1) YEAR AFTER THE CAUSE OF ACTION ACCRUES OR IT WILL BE BARRED.

2. PURCHASER'S REPRESENTATIONS & WARRANTIES

Purchaser represents and warrants that the product(s) conveyed by this contract shall not be used in or in connection with a nuclear facility or application. The parties agree that this representation and warranty is material and is being relied on by Seller. This provision may be modified in a separate writing signed by an officer of Price Pump Co.

3. PATENTS

Seller agrees to assume the defense of any suit for infringement of any patents brought against Buyer to the extent of such suit charges infringement of an apparatus or product claim by Seller's product in and of itself, provided (i) said product is built entirely to Seller's design, (ii) Buyer notifies Seller in writing of the filing of such suit within ten (10) days after the service of process thereof, and (iii) Seller is given complete control of the defense of such suit, including the right to defend, settle and make changes in the product for the purpose of avoiding infringement of any process or method claims, unless infringement of such claims is the result of following specific instruction furnished by Seller.

4. EXTENT OF SUPPLY

Only products as listed in Seller's proposal are included in this agreement. It must not be assumed that Seller has included anything beyond same.

5. MANUFACTURING SOURCES

To maintain delivery schedules, Seller reserves the right to have all or any part of the Buyer's order manufactured at any of Seller's, Seller's licensees or sub licensees.

6. TERMS OF PAYMENT

Net 30 days from date of invoice.

7. ARBITRATION

In the event a dispute arises between the parties relating to or arising out of this agreement, the parties agree to attempt to have their senior management amicably settle the matter. In the event that the matter cannot be settled, the parties shall submit all disputes relating to this Agreement (whether contract, tort, products liability or otherwise) to binding Arbitration before a panel of arbitrators (under the Commercial Dispute Resolution Procedures of the American Arbitration Association). Each party shall appoint an arbitrator and the third shall be selected in accordance with the rules of the American Arbitration Association. Judgment by the award may be entered in any court having jurisdiction. The parties shall cooperate in providing reasonable disclosure of relevant documents, facts, and the arbitrator's expenses, and the cost and fees of the arbitration shall be borne as allocated by the Arbitrator.

Dayton Fractional HP Motors

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Motor Installation and Maintenance Information

*Please read and save these instructions.
Read carefully before attempting to assemble,
install, operate or maintain the product described.
Protect yourself and others by observing all safety
information. Failure to comply with instructions
could result in personal injury and/or property
damage! Retain instructions for future reference.*

Dayton[®]

Initial Inspection and Handling

- After opening carton, look for concealed damage. If concealed damage is found, immediately file claim with carrier.
- Check the nameplate to verify that data conforms to specifications of motor ordered.

⚠ DANGER

High voltage and moving parts around motors and motor driven equipment can cause serious or fatal injuries. Always disconnect power source before working on a motor or its connected load. Installation must conform to all OSHA requirements, and the National Electrical Code (NEC) in the United States, and all local codes.

Electrical – Motor must be securely and adequately grounded by wiring with a grounded metallic conduit, or other grounding method approved by the NEC and local codes.

Insulate all connections carefully to prevent grounding or short circuits. Reinstall all conduit and terminal box covers. Do not force connections into the conduit box.

Thermal Protection – Use thermally protected motors or a motor starter incorporating thermal overload protection wherever required by safety regulations such as NEC or Underwriters Laboratories (UL) Standards in the United States; or where overloading, jamming or other abnormal operating conditions may occur. Under low temperature conditions, manual reset protectors may reset automatically, causing motor to start unexpectedly. **Always disconnect power before working on equipment.**

Mechanical – Guard all moving parts. Remove the shaft key before running the motor without a connected load. Be careful when touching the exterior of an operating motor! Motor may be hot enough to be painful or cause injury. This condition is normal for most motors when operated at rated load and voltage. Do not use the motor in a hazardous location as defined by Article 500 of the National Electrical Code (NEC).

Storage – Motor should be stored indoors in a clean, dry location.

Location

- **Open, Dripproof Motor** – Clean dry locations with access to an adequate supply of cooling air.
- **Totally Enclosed Motor** – Harsher environments where damp and dirty conditions may exist. Totally enclosed motors are not water-proof.
- Use only UL listed **Hazardous Location** motors for service in **Hazardous Locations** as defined in Article 500 of the NEC.
- Temperature around the motor should not exceed 104°F (40°C). Minimum temperature is -20°F (-29°C).
- If the motor nameplate indicates "Air-Over, Cont. A.O., etc.", the motor must be mounted in the air stream of an air moving device.

⚠ CAUTION

Not for fans in unattended areas. Refer to the following for proper thermal protection, and other motor selection information.

UL 507 STANDARD – FANS FOR USE IN UNATTENDED AREAS (PARAGRAPHS 125 & 126)

Any motor used in a fan product, such as bathroom exhaust fans, wall-insert fans, ceiling-insert fans, attic exhaust fans, whole house fans and duct fans, etc., which are built into or within the building structure and which are likely to operate unattended or in situations in which the operator may not detect a locked rotor (stalled motor) condition must have either a manual reset thermal protector or a thermal cut-off (one-shot) device. Rangehoods, circulating fans, pedestal fans and ceiling suspended fans are not included. Agricultural fans are included, if they are built into the building structure and are likely to operate unattended or in situations in which the person operating the fan may not detect a locked rotor (stalled motor) condition.

Power Source

- Voltage, frequency and phase of the power supply must correspond to that shown on the motor nameplate. Low voltage can reduce performance and cause overheating.
- On three-phase power, voltages on all three lines should be balanced within 1%. Unbalanced voltages cause motor overheating and poor performance.

Motor Control Devices

- Use of a suitable motor starting device is advisable and usually required by local electrical codes.
- Power supply must have fuses or circuit breakers to provide short circuit protection for the motor and controller.
- Where a motor starter is used, follow the control manufacturer's recommendations on heater selection or setting. If an existing controller is to be used with a replacement motor, new heaters may be required.
- Any switching device used to control motor must have a horsepower rating equal to or greater than the motor.
- An electronic adjustable speed control must not be used unless the motor has been specifically designed for such applications.

Motor Mounting

Motor must be securely fastened to prevent vibration and minimize noise. For secure mounting use high-quality bolts of the largest possible diameter. Where possible, sleeve bearing motors should be mounted with oil ports up and accessible.

Belt-drive sheaves must be in-line. Use a straight edge to check. Do not over-tighten belts.

Direct-coupled installations require a careful check of shaft and coupling alignment. Shim motor base as necessary. Do not depend on a flexible coupling to compensate for misalignment.

Table A – Minimum Wire Sizes for Three-Phase Motors

Motor HP	25 to 50 Feet			100 Feet			150 to 200 Feet		
	200V	230V	460V	200V	230V	460V	200V	230V	460V
1/8	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(16)*	14(16)*	14(18)*
1/6	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14	14(16)*	14(18)*
1/4	14(18)*	14(18)*	14(18)*	14(16)*	14(18)*	14(18)*	14	14	14(18)*
1/3	14(18)*	14(18)*	14(18)*	14(16)*	14(18)*	14(18)*	12	14	14(18)*
1/2	14(16)*	14(18)*	14(18)*	12	14(16)*	14(18)*	10	12	14(18)*
3/4	14(16)*	14(16)*	14(18)*	12	14	14(18)*	10	10	14(16)*
1	14	14(16)*	14(18)*	12	12	14(18)*	8	10	14(16)*
1 1/2	12	14	14(18)*	10	10	14(16)*	6	8	14
2	12	12	14(18)*	8	10	14(16)*	6	6	12
3	10	12	14(18)*	6	8	14	4	6	12

NOTE: NEC Article 310-5 Minimum conductor size for General Wiring at 115-440VAC is No. 14AWG.

Connecting Power to Motor

To connect motor for proper voltage and rotation, refer to the connection diagram on the nameplate or inside the terminal/conduit box.

Table B – Minimum Wire Sizes for Single-Phase Motors

Motor HP	25 Feet		50 Feet		100 Feet		150 feet		200 feet	
	115V	230V	115V	230V	115V	230V	115V	230V	115V	230V
1/8	14(18)*	14(18)*	14	14(18)*	12	14(18)*	10	14(16)*	8	14
1/6	14(16)*	14(18)*	12	14(18)*	10	14(16)*	6	14	6	12
1/4	14	14(18)*	10	14(16)*	8	14	6	12	4	10
1/3	14	14(18)*	10	14(16)*	8	14	6	12	4	10
1/2	12	14(18)*	8	14	6	12	4	10	3	8
3/4	10	14(16)*	6	12	4	10	2	8	1	6
1	10	14(16)*	6	12	4	10	2	8	1	6
1 1/2	8	14	6	12	3	8	1	6	1/0	6
2	8	14	4	10	2	8	1/0	6	2/0	4
3	6	12	3	8	1/0	6	2/0	4	4/0	3

NOTE:

■ NEC Article 310-5 — Minimum conductor size for general wiring at 115-440VAC is No. 14AWG.

■ Above wire sizes based on approximate 5% voltage drop during starting; copper conductors; and 75°C type THHW, THW, THWN, RH, RHW insulation, etc. For aluminum wire, increase two wire size steps minimum. See NEC Article 310 for ampacities of aluminum conductors.

■ Type S, SO, SJ, SJO, etc. flexible cable wire sizes. See NEC Article 400 for ampacity.

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⚠ WARNING *All aspects of the installation must conform to the requirements of the NEC, including Article*

430 (Motor Circuits and Controllers), and all local codes. *Wherever possible, each motor should be powered from a separate circuit of adequate capacity to keep voltage drop to a minimum during starting and running. Increase wire size where motor is located a distance from the power source. Wire size must be adequate to minimize voltage drop during starting and running. Refer to Tables A and B for suggested wire sizes. Distances shown are one-way between source and motor. Portable cords, if used, should be as short as possible to minimize voltage drop. Long or inadequately sized cords, especially on hard starting loads, can cause motor failure. All electrical connections in system must be secure to prevent voltage drop and localized heating.*

■ Determine direction of rotation before connecting driven equipment to prevent damage.

■ To prevent bearing damage, do not strike shafts with hammer or other tool.

■ If the motor has been damp or wet, have motor serviced by a qualified motor repair shop before operating.

Starting Motor

Be sure motor is properly grounded.

Connect motor to load and run briefly. Check for unusual noises and vibration (see Troubleshooting). Check motor current; it should be close to nameplate.

Visually re-inspect the installation. Make sure that the guards and other protective devices are securely in place. All covers and gaskets must be re-installed to minimize the entry of dirt and moisture.

⚠ DANGER *Before performing any maintenance, disconnect power and allow motor to come to a complete stop. Discharge capacitors, if any, for safety.*

Recommended Maintenance

Remove dirt accumulations in and around vent openings, by vacuuming. **Dirt accumulations can cause motor overheating and a fire hazard.** Enclosed motors can be cleaned with an air jet; wear eye protection.

Periodically inspect the installation. Check for dirt accumulations; unusual noises or vibration; overheating; worn or loose couplings, sheaves and belts; high motor current; poor wiring or overheated connections; loose mounting bolts or guards; and worn motor starter contacts.

Exercise caution with solvents; some solvents may attack motor insulation, finish or bearing lubricants; some are highly flammable. If solvents are used, make sure area is well ventilated.

Sleeve bearing motors require periodic reoiling. Follow reoiling instructions on the motor (See nameplate or terminal box cover). If instructions are not included, re-oil continuous duty units once a year, intermittent duty units every two years and occasional duty units every five years with 30 to 35 drops of SAE No. 20 non-detergent or electric motor oil. Do not overlubricate.

Dayton ball bearing motors are pre-lubricated at the factory and do not require relubrication.

Troubleshooting

This chart suggests common answers to electric motor problems. The information is not all-inclusive and does not necessarily apply in all cases. When unusual operating conditions, repetitive failures, or other problems occur, consult an electric motor service firm for assistance.

Symptoms	Possible Cause(s)	Corrective Action
Motor fails to start	Blown fuses	Replace with time-delay fuses. Check for grounded winding
	Tight shaft	Occasionally during shipment a sleeve bearing motor may be received with a shaft which does not rotate freely. It may be necessary to strike the motor, at the shell/endshield rabbet, with a rawhide or plastic mallet to align the bearings
	Voltage too low at motor terminals due to line drop	Consult local power company. Increase wire size (refer to Tables A & B). Check for poor connections
	Overload in motor starter tripped	Check and reset overload relay in starter. Check heater rating against motor nameplate current rating
	Overload (internal thermal protector) tripped	Check motor load. If motor has an automatic or manual reset thermal protector, check if tripped
	Improper line connections	Check connections against diagram supplied with motor
	Motor may be overloaded Defective motor or starter Not applied properly	Reduce load or increase motor size Repair or replace Consult motor service firm for proper type. Use larger motor
Motor does not come up to speed or takes too long to accelerate	Voltage too low at motor terminals	Increase wire size (refer to Tables A & B). Check for poor connections. Check for voltage unbalance (3-phase)
	Starting load too high	Check load motor is carrying at start
	Excess loading; tight belts	Reduce load; increase motor size. Adjust belts
	Defective motor Inadequate starting torque. High inertia load	Repair or replace Replace with larger motor
Motor stalls during operation	Overloaded motor	Reduce load or increase motor size
	Low motor voltage	Verify that nameplate voltage is maintained
Motor vibrates or is excessively noisy	Motor shaft misaligned	Realign
	Three-phase motor running single phase	Check for open circuit, blown fuses or unbalanced voltages
	High or unbalanced voltages	Check wiring connections. Consult local power company
	Worn, damaged, dirty or overloaded bearings	Repair or replace motor; check loading and alignment
	Defective winding. Bent or bowed shaft	Repair or replace
	Loose sheave or mis-aligned coupling	Tighten setscrew(s); realign coupling

Symptoms	Possible Cause(s)	Corrective Action
<div> <div>E</div> <div>N</div> <div>G</div> <div>L</div> <div>I</div> <div>S</div> <div>H</div> </div> Motor overheats while running under load	Overloaded	Reduce load; increase motor size; belts may be too tight
	Dirt blocking ventilation openings	Clean motor
	If three-phase, one phase may be open	Check lines for open phase. Check voltage with motor disconnected, one fuse may be blown
	Unbalanced supply voltage	Check for faulty connections. Voltage on all three lines should be balanced within 1%. Excessive single phase loads
	Faulty connection	Clean, tighten, or replace
	High or low voltage	Check voltage at motor, should not be more than 10% above or below rated
	Defective motor	Repair or replace

Order Replacement Parts By Calling Toll Free 1-800-323-0620

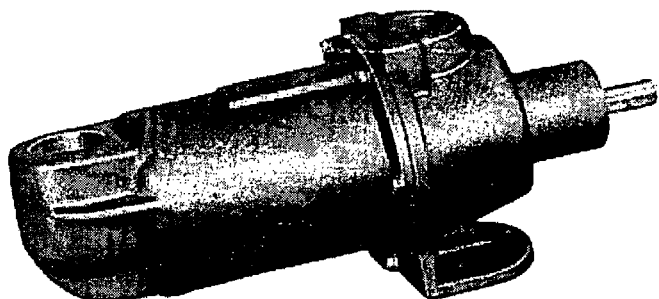
Please provide following information:

- Model Number
- Serial Number (if any)
- Part Description and Number as shown in Parts List.

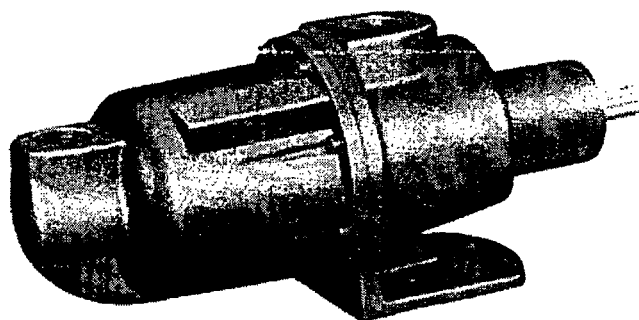
Address parts correspondence to:

Grainger Parts Operations
P.O. Box 3074
1657 Shermer Road
Northbrook, IL 60065-3074

SERVICE MANUAL
MOYNO® 500 PUMPS
300 SERIES
331, 332, 333, 344, 356 AND 367 MODELS



Mechanical Seal Models



Packing Gland Models

DESIGN FEATURES	MODELS				
	33101 34401	33104 34404	33108 33308 33208 34408	34411	35613
	33201 35601	33204 35604		35611	
Housing:	Cast Iron	AISI 316 SS	Nylon	Cast Iron	AISI 316 SS
Pump Rotor:	Chrome plated 416 SS	Chrome plated 316 SS	Chrome plated 416 SS	Chrome plated 416 SS	Chrome plated 316 SS
Pump Stator:	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)	NBR (Nitrile)
Shaft:	416 SS	316 SS	416 SS	416 SS	316 SS
Flexible Joint:	Carbon steel/ NBR	316 SS/ NBR	Carbon steel/ NBR	Carbon steel/ NBR	316 SS/ NBR
Bearings:	Ball (sealed)	Ball (sealed)	Ball (sealed)	Ball (sealed)	Ball (sealed)
Mechanical Seal:	Carbon-ceramic	Carbon-ceramic	Carbon-ceramic	---	---
Packing:	---	---	---	Braided PTFE	Braided PTFE

Note: Alternate elastomers available. Refer to Repair/Conversion kit numbers, page 8.

INSTALLATION

Mounting Position. Pump may be mounted in any position. When mounting vertically, it is necessary to keep bearings above seals to prevent possible seal leakage into bearings.

Pre-Wetting. Prior to connecting pump, wet pump elements and mechanical seal or packing by adding fluid to be pumped into suction and discharge ports. Turn shaft over several times in a clockwise direction to work fluid into elements.

Piping. Piping to pump should be self-supporting to avoid excessive strain on pump housings. See Table 1 for suction and discharge port sizes of each pump model. Use pipe "dope" or tape to facilitate disassembly and to provide seal.

Drive. On belt driven units, adjust belt tension to point of non-slip. Do not overtighten.

On direct drive units, coupling components should be aligned and spaced at least 1/16" apart.

Pump rotation must be clockwise when facing shaft to prevent damage to pump. Check direction of rotation before startup.

Water Flush of Packing (356 Models Only). The packing may be either grease lubricated through a grease fitting in the stuffing box or have plumbing connected to the housing to allow a water flush.

Maximum speed is 1750 rpm.

When the material being pumped is abrasive in nature, it may be advantageous to flush the packing to prevent leakage under packing and excessive shaft wear.

Clean water can be injected through a 1/8" NPT tapped hole that normally houses the grease fitting for lubricating the packing. The water can be permitted to leak axially along the shaft in either direction or can be removed from the second tapped hole in the stuffing box. In both cases, the discharge from the stuffing box should be throttled slightly to maintain 10-15 PSI higher pressure in the stuffing box than is present in the discharge housing.

Table 1. Pump Data

Pump Models	331	332	333	344	356	367
Suction Port (NPT)	3/4*	3/4*	3/4*	3/4*	1-1/2	2
Discharge Port (NPT)	3/4	3/4	3/4	3/4	1-1/4	2
Discharge Pressure (psig)	150	100	50	40	50	50

*08 versions = 1" NPT

Table 2. Temperature Limits

Elastomer	Temperature Limits
*NBR	10°-160°F
*EPDM	10°-210°F
*FPM	10°-240°F

*NBR = Nitrile

*EPDM = Ethylene-Propylene-Diene Terpolymer

*FPM = Fluoroelastomer

OPERATION

Self-Priming. With wetted pumping elements, the pump is capable of 25 feet of suction lift when operating at 1750 rpm with pipe size equal to port size.

DO NOT RUN DRY. Unit depends on liquid pumped for lubrication. For proper lubrication, flow rate should be at least 10% of rated capacity.

Pressure and Temperature Limits. See Table 1 for maximum discharge pressure of each model. Unit is suitable for service at temperatures shown in Table 2.

Storage. Always drain pump for extended storage periods by removing suction housing bolts and loosening suction housing.

TROUBLE SHOOTING

WARNING: Before making adjustments, disconnect power source and thoroughly bleed pressure from system. Failure to do so could result in electric shock or serious bodily harm.

Failure To Pump.

1. Belt or coupling slip: Adjust belt tension or tighten set screw on coupling.
2. Stator torn; possibly excessive pressure: Replace stator, check pressure at discharge port.
3. Wrong rotation: Rotation must be clockwise when facing shaft.

4. Threads in rotor or on shaft stripped: Replace part. Check for proper rotation.
5. Excessive suction lift or vacuum.

Pump Overloads.

1. Excessive discharge pressure: Check discharge pressure for maximum rating given in Table 1. Check for obstruction in discharge pipe.
2. Fluid viscosity too high: Limit fluid viscosity to 20,000 CP or 100,000 SSU.

Viscosity CP	Limit RPM
1-300	1750
300-1,000	1200
1,000-2,000	700
2,000-5,000	350
5,000-10,000	180
10,000-20,000	100

3. Insufficient motor HP: Check HP requirement.

Noisy Operation.

1. Starved suction: Check fluid supply, length of suction line, and obstructions in pipe.
2. Bearings worn: Replace parts; check alignment, belt tension, pressure at discharge port.
3. Broken flexible joint: Replace part, check pressure at discharge port.
4. Insufficient mounting: Mount to be secure to firm base. Vibration induced noise can be reduced by using mount pads and short sections of hose on suction and discharge ports.

Mechanical Seal Leakage (Mechanical Seal Models Only).

1. Leakage at startup: If leakage is slight, allow pump to run several hours to let faces run in.
2. Persistent seal leakage: Faces may be cracked from freezing or thermal shock. Replace seal.

Packing Leakage (Packing Models Only).

1. Leakage at startup: Adjust packing as outlined in maintenance instructions.

Note: Slight leakage is necessary for lubrication of packing.

2. Persistent leakage: Packing rings and/or shaft may be worn. Replace parts as required.

Pump Will Not Prime.

1. Air leak on suction side: Check pipe connections.

MAINTENANCE

General. These pumps have been designed for a minimum of maintenance, the extent of which is routine lubrication and adjustment of packing. The pump is one of the easiest to work on in that the main elements are very accessible and require few tools to disassemble.

Packing Lubrication (356 Models Only). The zerk fitting on the side of the suction housing leads to the lantern ring halves in the mid-section of the packings. At least once a week, inject a small quantity of good quality grease, such as MPG-2 Multi Purpose Grease (Du Bois Chemical), or equivalent, into the zerk fitting to lubricate the packings.

Note: For Model 34411, lubricate packing by applying a liberal amount of grease during assembly.

Packing Adjustment (Packing Models Only).

Packing gland attaching nuts should be evenly adjusted so they are little more than finger tight. Over-tightening of the packing gland may result in premature packing failure and possible damage to the shaft and gland.

When the packing is new, frequent minor adjustments are recommended for the first few hours of operation in order to compress and seat the packing. Be sure to allow slight leakage for lubrication of packing.

When excessive leakage can no longer be regulated by tightening the gland nuts, remove and replace the packings in accordance with the DISASSEMBLY and REASSEMBLY instructions. The entire pump need not be disassembled to replace the packings.

Bearing Lubrication. The prelubricated, fully sealed bearings do not require additional lubrication.

PUMP DISASSEMBLY

WARNING: Before disassembling pump, disconnect power source and thoroughly bleed pressure from system. Failure to do so could result in electric shock or serious bodily harm.

To Disassemble Mechanical Seal Models:

1. Disconnect suction and discharge piping.
2. Remove screws (112) holding suction housing (2) to pump body (1). Remove suction housing and stator (21).
3. Remove rotor (22) from flexible joint (24) by turning counter-clockwise (RH thread). Use 3/16 inch diameter punch to remove rotor pin (45) on Model 36701.
4. Flexible joint (24) can be removed from shaft (26) by using a 3/16 inch allen wrench in end of joint (1/4 inch wrench on 356 Models) and turn counter-clockwise. Use 3/16 inch diameter punch to remove shaft pin (46) on Model 36701.
5. Carefully slide mechanical seal (69) off shaft (26). Carefully pry seal seat out of pump body (1). If any parts of mechanical seal are worn or broken, the complete seal assembly should be replaced. Seal components are matched parts and are not interchangeable.
6. The bearings (29) and shaft (26) assembly can be removed from pump body (1) after snap ring (66) has been removed. To remove the assembly, lightly tap the shaft at threaded end using a block of wood to protect the threads. The bearings may be pressed off the shaft.

To Disassemble Packing Models:

1. Disconnect suction and discharge piping.
2. Remove screws (112) which hold suction housing (2) to pump body (1). Remove suction housing and stator (21).
3. Remove rotor (22) from flexible joint (24) by turning in a counter-clockwise direction (RH thread).
4. Flexible joint (24) can be removed by using a 3/16 inch allen wrench in end of joint (1/4 inch wrench on 356 Models) and turn in a counter-clockwise direction.
5. The packing (42) can be removed without removing the shaft (26) using the following procedure:
 - a. Remove gland bolts (47).
 - b. Slide gland (41) away from packing (42).
 - c. Pull out packing (42) (and lantern ring halves (57) on 356 Models) using a packing removing tool.

Note: Packing can be removed after shaft has been removed by pushing out from pump side of pump body after gland (41) has been detached.

6. The bearings (29) and shaft (26) assembly can be removed from pump body (1) after snap ring (66) has been removed. To remove the assembly, lightly tap the shaft at threaded end using a block of wood to protect the threads.
7. To disassemble shaft assembly, remove snap ring (66A) from shaft (26) and press bearings (29) and bearing spacer (33) off the shaft.

PUMP ASSEMBLY**To Assemble Mechanical Seal Models:**

1. Press bearings (29) on shaft (26), and locate slinger ring (77) near bearing on threaded end of shaft.

Note: When replacing bearings, always press on the inner race when assembling to shaft, and on the outer race when pressing bearings into the housings.

2. Press shaft assembly into pump body (1) securing with snap ring (66).
3. Install mechanical seal (69) using the following procedure:
 - a. Clean and oil sealing faces using a clean light oil (not grease).

Caution: Do not use oil on EPDM parts. Substitute glycerin or soap and water.

- b. Oil the outer surface of the seal seat, and push the assembly into the bore in the pump body (1), seating it firmly and squarely.
 - c. After cleaning and oiling the shaft, slide the seal body along the shaft until it meets the seal seat.
 - d. Install seal spring and spring retainer on shaft.
4. Thread flexible joint (24) into shaft (26) in a clockwise direction (RH thread). On 356 Models, install seal spacer (69A) and washer (116) before threading flexible joint onto shaft in a clockwise direction. On Model 36701, use shaft pin (46) to pin flexible joint (24) to shaft.
 5. Thread rotor (22) onto flexible joint (24) in a clockwise direction (RH thread). On Model 36701, pin rotor (22) to joint using rotor pin (45).
 6. Slide stator (21) on rotor (22). On 331 and 332 Models, insert rounded end of stator ring (135) into end of stator prior to installing stator on rotor.
 7. Secure stator (21) and suction housing (2), with suction port vertically up, to pump body (1) using screws (112).
 8. Proceed as in installation instructions.

To Assemble Packing Models:

1. Press bearings (29), with bearing spacer (33) in between, on shaft (26) and secure in place using snap ring (66A).

Note: When replacing bearings, always press on the inner race when assembling to shaft, and on the outer race when pressing bearings into the housings.

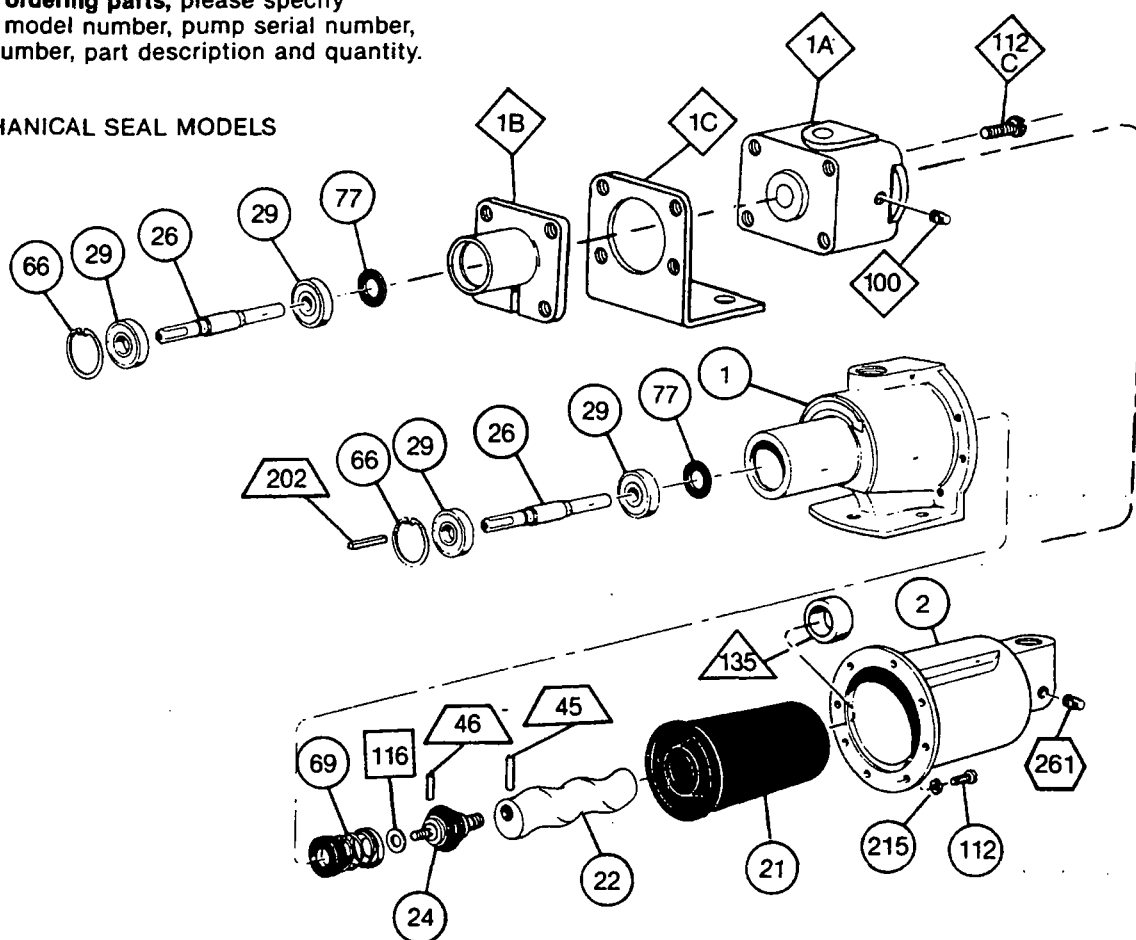
2. Install packing (42) before installing shaft assembly using the following procedure:
 - a. Lubricate each individual ring of packing with a grease that is insoluble in the fluid being pumped.
 - b. Individually assemble each ring of packing loosely in the packing chamber of the pump body (1). Stagger splits on rings. (Four rings, 3/16 inch square required on Model 34411; four rings, 1/4 inch square and two lantern ring halves (57) assembled between two rings on 356 Models).
 - c. Loosely install packing gland (41) on pump body (1) using gland bolts (47).
3. Press shaft assembly into pump body (1) positioning slinger ring (77) between packing gland (41) and bearing end of pump body. Secure the shaft assembly with snap ring (66).
4. Thread flexible joint (24) into shaft (26) in a clockwise direction (RH thread).
5. Thread rotor (22) onto flexible joint (24) in a clockwise direction (RH thread).
6. Slide stator (21) on rotor (22). On 331 and 332 Models, insert rounded end of stator ring (135) into end of stator prior to installing stator on rotor.
7. Secure stator (21) and suction housing (2), with suction port vertically up, to pump body (1) using screws (112).
8. Proceed as in installation instructions.

Note: Adjust newly installed packing as described in maintenance procedure.

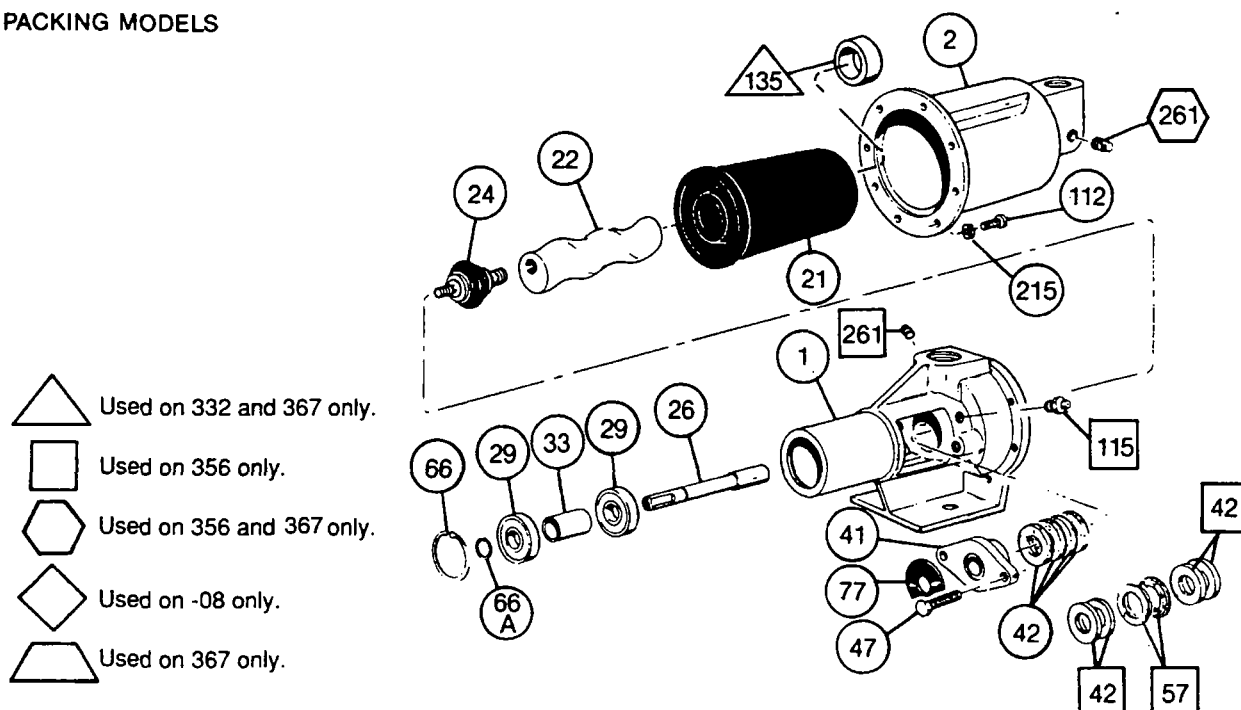
WARNING: Replace belt or coupling guards before reconnecting power.

When ordering parts, please specify
 pump model number, pump serial number,
 part number, part description and quantity.

MECHANICAL SEAL MODELS



PACKING MODELS



PARTS LIST — 331, 332, 333, AND 344 MODELS

Item No.	Description	Mechanical Seal Models			Packing Gland Models
		33101 33201 33301 34401	33104 33204 33304 34404	33108 33208 33308 34408	
1	Pump Body	330-1065-002	330-1910-002		340-1000-001
1A	Discharge Housing			340-2362-000	
1B	Bearing Housing			330-4587-000	
1C	Pump Base			340-2369-000	
2	Suction Housing	330-1064-002	330-1911-002	330-4536-000	330-1064-002
*21	Stator	See Stator section below.			
*22	Rotor	See Rotor section below with circled numbers for each series.			
		①	②	①	①
24	Joint	Carbon Steel/NBR 320-1511-000	316 SS/NBR 320-3759-000	Carbon Steel/NBR 320-1511-000	
26	Drive Shaft	320-1499-000	320-2938-000	320-1499-000	320-2448-000
29	Bearing (2 req.)	630-0502-031			
33	Bearing Spacer				320-1900-000
41	Packing Gland				320-0101-004
42	Packing				340-3396-005
47	Gland Bolt				619-1520-161
66	Snap Ring	320-1506-000			
66A	Snap Ring				320-4182000
69	Mechanical Seal		320-2424-000		
77	Slinger Ring		320-6382-000		320-6384-000
100	Pipe Plug (3 req.)			610-0120-021	
112	Screws (8 req.)	619-1430-103	320-5968-000	619-0860-081	619-1430-103
112C	Screws (4 req.)			61 9-0890-281	
135	Stator Ring (331 -332 only)		320-7812-000		
215	Lock Washer (8 req.)		320-6464-000		

*Recommended spare parts.

STATORS		Models			
		331	332	333	344
21	Standard Stator, NBR All Models	340-3501-120	340-3502-120	340-3503-120	340-3504-120
21	EPDM Stator	340-3501-320	340-3502-320	340-3503-320	340-3504-320
21	FPM Stator	340-3501-520	340-3502-520	340-3503-520	340-3504-520
ROTORS					
22	① 416SS - All Models	320-2729-000	330-0906-000	320-1394-000	320-1841-000
22	② 316SS - All Models	320-2933-000	320-2942-000	320-2936-000	320-2934-000

See page 8 for Repair/Conversion Kits

PARTS LIST — 356 AND 367 MODELS

Item No.	Description	Mechanical Seal Models		Packing Gland Models		Mechanical Seal Model	
		35601	35604	35611	35613	36701	36704
1	Pump Body	Cast Iron 340-0636-000	316SS 340-1550-000	Cast Iron 350-0420-000	316SS 350-0491-000	Cast Iron 350-0423-000	316SS 350-0423-007
2	Suction Housing	350-0280-000	350-0489-000	350-0280-000	350-0489-000	350-0302-000	350-0302-007
*21	Stator	NBR 340-3505-120		NBR 340-3505-120		NBR 340-3506-120	
22	Rotor	416SS 320-2304-000	316SS 320-4431-000	416SS 320-2304-000	316SS 320-4431-000	416SS 330-2042-000	316SS 330-3077-000
24	Flex Joint	Carbon Steel 320-1583-000	316SS 320-4427-000	Carbon Steel 320-1583-000	316SS 320-4427-000	Carbon Steel 320-1749-000	316SS 320-4436-000
26	Drive Shaft	320-1759-000	320-4430-000	320-2765-000	320-4435-000	330-1805-000	330-1805-015
29	Bearing (2 req.)	630-0552-051				630-0552-061	
33	Bearing Spacer			320-2764-000			
41	Packing Gland			320-0003-004	320-0003-007		
*42	Packing			340-3396-008			
45	Rotor Pin					320-4439-002	
46	Shaft Pin					320-4439-001	
47	Gland Bolt			619-1530-241			
57	Lantern Ring Half**			320-6585-000			
66	Snap Ring	320-1758-000				320-2794-000	
66A	Snap Ring			320-3533-000			
*69	Mechanical Seal	320-3945-000				320-1750-000	
69A	Seal Spacer	320-4434-000					
77	Slinger Ring	320-6383-000		320-6385-000		320-6385-000	
112	Screws (6 req.)	619-1530-161				619-1530-161	
115	Zerk Fitting			320-2503-001			
135	Stator Spacer	330-7594-000					
202	Shaft Key					611-0040-240	
215	Lock Washer (6 req.)	623-0010-411					
261	Pipe Plug	610-0120-011	610-0420-010	610-0120-011	610-0420-010	610-0120-011	610-0420-010

*Recommended spare parts.

**2 Required

See page 8 for Repair/Conversion Kits

REPAIR/CONVERSION KIT NUMBERS

ELASTOMER REPAIR/CONVERSION KITS

Item No.	Description	331 Models			332 Models		
		NBR	EPDM	FPM	NBR	EPDM	FPM
—	Kit No.	311-9026-000	311-9025-000	311-9054-000	311-9027-000	311-9038-000	311-9055-000
21	• Stator	340-3501-120	340-3501-320	340-3501-520	340-3502-120	340-3502-320	340-3502-520
24	• Joint	320-1511-000†	320-6367-000†	320-4670-000†	320-1511-000†	320-6367-000†	320-4670-000†
69	• Seal	320-2424-000	320-6379-000	320-6501-000	320-2424-000	320-6379-000	320-6501-000
Item No.	Description	333 Models			344 Models		
		NBR	EPDM	FPM	NBR	EPDM	FPM
—	Kit No.	311-9029-000	311-9028-000	311-9056-000	311-9031-000	311-9030-000	311-9057-000
21	• Stator	340-3503-120	340-3503-320	340-3503-520	340-3504-120	340-3504-320	340-3504-520
24	• Joint	320-1511-000†	320-6367-000†	320-4670-000†	320-1511-000†	320-6367-000†	320-4670-000†
69	• Seal	320-2424-000	320-6379-000	320-6501-000	320-2424-000	320-6379-000	320-6501-000

†316SS/with appropriate elastomer.

‡Carbon steel. NBR kits are available only with carbon steel joints; a 316SS/NBR joint for 331-344 Models is available as 320-3759-000.

Item No.	Description	356 Models			367 Models		
		NBR	EPDM	FPM	NBR	EPDM	FPM
—	Kit No. (Mech. Seal Models)	311-9033-000	311-9032-000	311-9058-000	311-9060-000	311-9036-000	311-9124-000
21	• Stator	340-3505-120	340-3505-320	340-3505-520	340-3506-120	340-3506-320	340-3506-520
24	• Flex Joint	320-1583-000†	320-6369-000†	320-4671-000†	320-1749-000†	320-6378-000†	320-6515-000†
69	• Seal	320-3945-000	320-6380-000	320-6510-000	320-1750-000	320-6390-000	320-6517-000
45	• Rotor Pins				320-4439-002	320-4439-002	320-4439-002
46	• Shaft Pin				320-4439-001	320-4439-001	320-4439-001
—	Kit No (Packing Gland Models)	311-9035-000	311-9034-000	311-9059-000			
21	• Stator	340-3505-120	340-3505-320	340-3505-520			
24	• Joint	320-1583-000†	320-6369-000†	320-4671-000†			

†316SS/with appropriate elastomer.

‡Carbon steel. NBR kits are available only with carbon steel joints; a 316SS/NBR joint for Model 35604 and 35613 pumps is available as 320-4427-000; a 316SS/NBR joint for model 36704 is available as 320-4436-000.

ABRASION RESISTANT SEALS

Elastomer	Models		
	331-344	356	36701
NBR	3206460000	3206505000	3206511000
EPDM	3206502000	3206506000	3206512000
FPM	3206503000	3206507000	3206513000

NBR = Nitrile

EPDM = Ethylene-Propylene-Diene Terpolymer

FPM = Fluoroelastomer



Always the Right Solution™

MOYNO, INC.
WARRANTY AND CLAIMS POLICY

The following statement of our Warranty and Claims Policy is intended to assist our customers in understanding the terms of our warranty, the circumstances under which we will honor claims, and the procedure for making claims.

Our Warranty and Claims Policy should be read in conjunction with and is subject in all respects to the terms and conditions of sale which appear on our quotation and acknowledgment forms and the specific terms of any distributorship or other such agreement between us and the individual customer.

1. Warranty on Products Manufactured by Us.

We warrant Products manufactured by us to be free from defects in material and workmanship for a period of one year from the shipment from our factory or warehouse.

Our liability under this warranty or in connection with any other claim relating to our products is limited to the repair, or at our option, the replacement or refund of the purchase price, of any Products or parts or components which are returned to us freight prepaid and which are defective in material or workmanship. Products or parts or components thereof which are repaired or replaced by us will be returned to our customer freight collect.

2. Products of Other Manufacturers.

We make no warranty with regard to any Products, including but not limited to electrical components or equipment and other prime movers, which are not manufactured by us. The only warranty which attaches to such Products is that warranty, if any, of the manufacturer of such Products. Our Customer Service Department should be consulted if our customers have questions as to whether particular Products are covered by our warranty or are separately warranted by their manufacturers.

3. Limitation of Liability.

The only warranty which we make to our customers is that warranty which is set forth on our quotation and acknowledgment forms and which is summarized above. **WE DO NOT MAKE ANY OTHER EXPRESS WARRANTIES OR ANY IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR USE.**

In addition, we do not assume and we expressly disclaim any liability for (i) any SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES which anyone may suffer as a result of the sale, delivery, servicing, use, or loss of use, of any Product, or (ii) any charges or expenses of any nature which are incurred without our express written consent.

Our total liability under our warranty or in connection with any claim involving any Product is expressly limited to the purchase price of the Product in respect of which damages are claimed.

4. What Is Not Covered By Our Warranty: Types of Damages and Claims For Which We Are Not Responsible.

The following are examples of the kinds of defects which are not covered by our warranty: defects which are caused by improper installation, improper or abnormal use or operation, or improper storage or handling; defects caused by our customer's failure to perform normal preventative maintenance; defects caused by the use of replacement parts not manufactured or supplied by us; defects caused by repairs by persons not authorized by us; defects caused by modifications or alterations made by our customer; and any damage to our Product occurring while it is in our customer's possession. Since these are examples and not a complete list, we suggest that our customers contact our Customer Service Department if they have any questions concerning the scope of our warranty.

Additional costs incurred by our customers because of delays in delivery are consequential damages for which we are not responsible.

Risk of loss or damage to our Products passes to our customer when we tender our Products to the carrier. Although we cannot process transit damage claims with any carrier on a customer's behalf, we will provide reasonable assistance to our customers when such claims arise.

5. Consultations With Customers.

When so requested, our engineers and other personnel may consult with our customers concerning our Products. While our employees will offer their best judgement on any question, the ultimate responsibility for selecting that Product which will perform the functions and applications desired by the customer rests with the customer. As noted above, we make no warranty, express or implied, as to the fitness of any Product for any particular purpose or use.

6. How To Make A Claim.

Within the limits of the terms and conditions set forth on our quotation and acknowledgement forms and in this Warranty and Claims Policy, we will honor reasonable and justified claims when adequate evidence is provided to show that our Product was defective.

Whenever a customer has a claim concerning a Product, the customer should contact the Sales or Customer Service Department. CUSTOMERS SHOULD NOT RETURN ANY PRODUCTS OR PARTS OR COMPONENTS TO US WITHOUT FIRST CONTACTING US.

When contacting us, customers should have the following information available:

1. Customer name, location, purchase order number and the date of purchase.
2. Product serial number (off nameplate).
3. Model number, including frame/type/trim (off nameplate).
4. Equipment installation date.
5. Equipment failure date.
6. Application or service of unit.
7. Details of claim.

We will notify the customer whether it will be necessary to return the Product or part or component to us. If so, we will send the customer an "AUTHORIZED RETURN GOODS TAG" that must be attached to the Product or part or component before returning it. All items returned to us must be returned freight prepaid.

If we determine that the Product or part or component is defective and that the defect is covered by our warranty, we will, as explained above, correct the defect or refund the purchase price.

Customers should promptly inspect all Products upon delivery. Claims for shortages must be made by our customers within 20 days after the date of shipment from our factory or warehouse. We suggest that shortages be noted on the bill of lading or packing list, which should then be sent to our Customer Service Department for verification.

All other claims must be submitted within 60 days after the date of shipment from our factory or warehouse, or in the case of an alleged breach of warranty, within 60 days after the date within the warranty period on which the defect is or should have been discovered.

Claims may not be deducted from payments made to us unless we have so agreed in writing in advance.

Moyno, Inc.

P.O. Box 960

Springfield, OH 45501-0960

U.S.A.

Telephone1-877-4UMOYNO

(Municipal).....937-327-3510

Facsimile937-327-3572

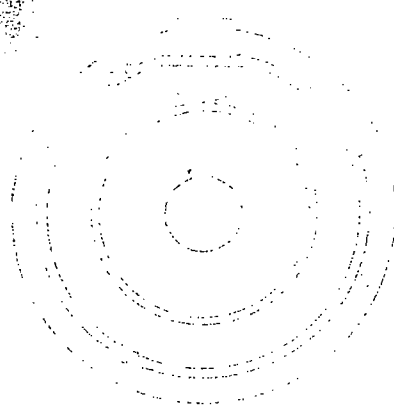
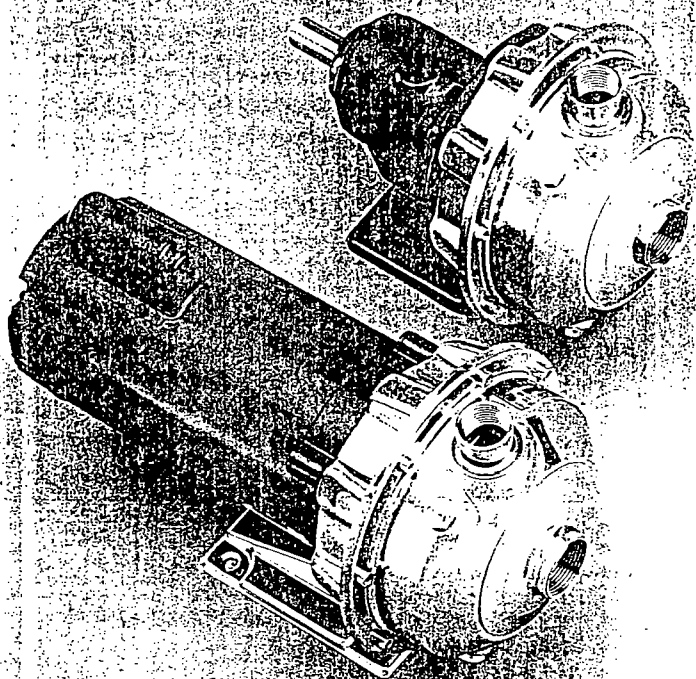
(Municipal).....937-327-3064

Web site: www.moyno.com

NPE 316L SS

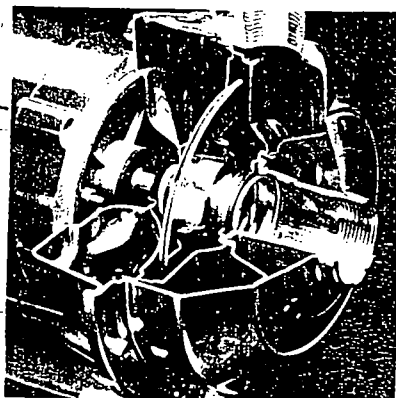
**NPE Series
End Suction
Centrifugal
Pumps**

**Bombas
Centrífugas de
Succión Final
Serie NPE**

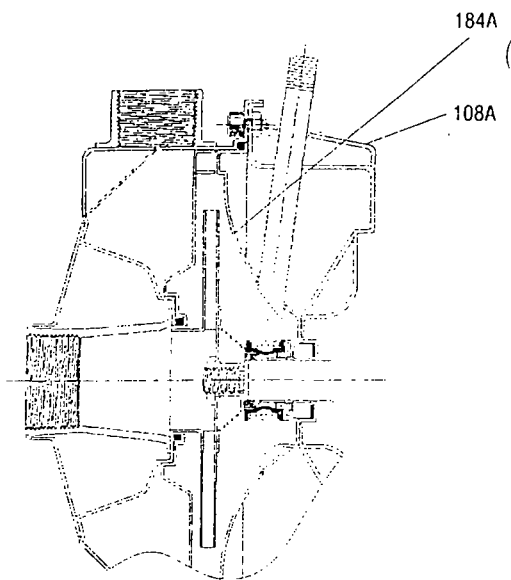
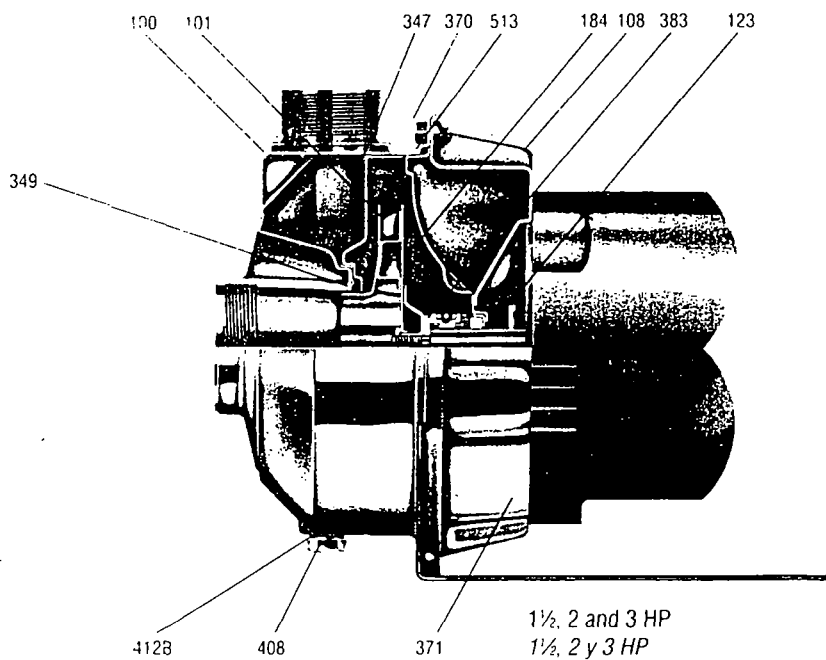


DISCHARGE
DESCARGA

SUCTION
SUCCIÓN

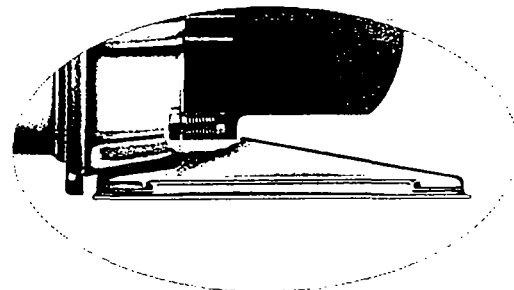


NPE Close Coupled Pump Major Components: Materials of Construction
Bomba Cerrada Acoplada NPE Componentes Principales: Materiales de Construcción



Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., Parte No.	Description, Descripción	Materials, Materiales
100	Casing, Carcasa	
101	Impeller, impulsor	
108	Motor adapter, Adaptador del motor	AISI 316L SS, AISI 316L Acero inoxidable
108A	Motor adapter seal vent/flush, Sello válvula/chorro del adaptador del motor	
123	Deflector, Deflector	BUNA-N
184	Seal housing, Alojamiento del sello	
184 A	Seal housing seal vent/flush, Sello válvula/chorro del alojamiento del sello	AISI 316L SS, AISI 316L Acero inoxidable
347	Guidevane, Difusor	
349	Seal ring, guidevane: Anillo del sello, difusor	Viton
370	Socket head screws, casing: Encajes cabezas de tornillos, carcasa	AISI 410 SS, AISI 410 Acero inoxidable
371	Bolts, motor; Tornillos, motor	Plated steel, Acero chapeado
383	Mechanical seal, Sello mecánico	**see chart, ver tabla
408	Drain and vent plug, casing: Enchufes de drenaje y válvula, carcasa	AISI 316L SS, AISI 316L Acero inoxidable
412B	O-ring, drain and vent plug: Anillo 'O', enchufe de drenaje y válvula	Viton
513	O-ring, casing: Anillo 'O', carcasa	
Motor	NEMA standard, 56J flange: NEMA estándar, brida 56J	



1/2, 3/4 and 1 HP
1/2, 3/4 y 1 HP

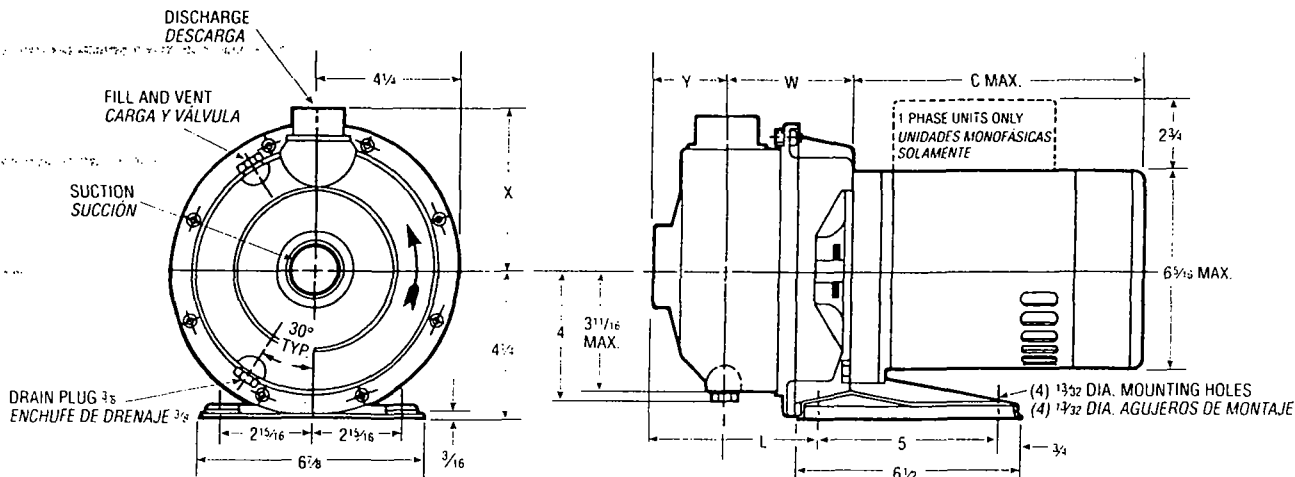
Footed motor for 1750 RPM and 5 HP ODP and TEFC, all explosion proof see page 13.

Motor con pie para 1750 RPM, 5 HP ODP y TEFC, a prueba de explosiones en la página 13.

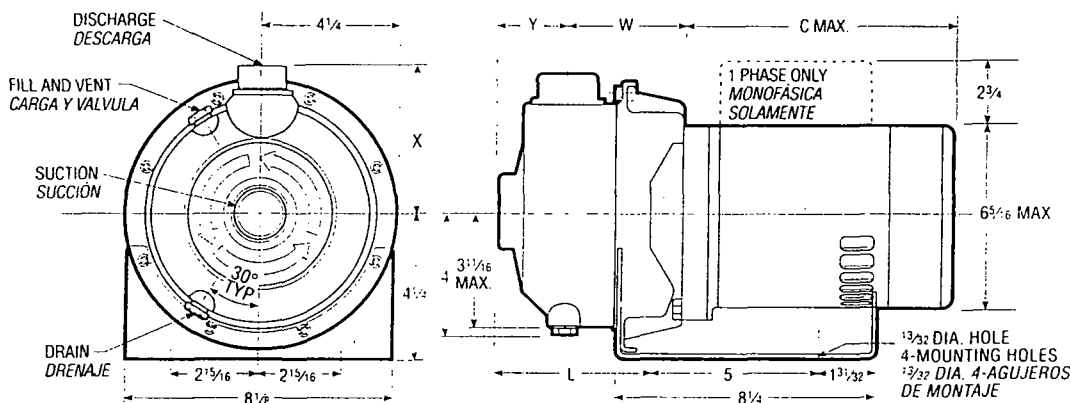
NPE Close Coupled – Dimensions, Weights and Specifications
NPE Acople Cerrado – Dimensiones, Pesos y Especificaciones

Clockwise Rotation Viewed from Drive End

Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



ODP and TEFC ½, ¾ and 1 HP, ODP y TEFC ½, ¾ y 1 HP



ODP and TEFC 1½, 2 and 3 HP, ODP y TEFC 1½, 2 y 3 HP

Specifications *Especificaciones*

Capacities to:

75 GPM (283L/min) at 1750 RPM
150 GPM (550L/min) at 3500 RPM

Heads to:

39 feet (11 m) at 1750 RPM
150 feet (50 m) at 3500 RPM

Working pressures to:

125 PSIG (9 bars)

Maximum temperatures to:

212°F (100°C) with standard seal
or 250°F (121°C) with optional
high temperature seal.

Direction of rotation:

Clockwise when viewed from
inglor end.

Motor specifications:

NEMA 56J frame, 1750 RPM.
 ½ HP. 3500 RPM ½ through 5 HP.
 Open drip-proof, totally enclosed
 fan-cooled or 2 HP explosion proof
 enclosures. Stainless steel shaft with
 ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/460 ODP, TEFC and EX PROOF.

NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:

75 GPM (283L/min) a 1750 RPM
150 GPM (550L/min) a 3500 RPM

Cargas:

39 pies (11 m) a 1750 RPM
150 pies (50 m) a 3500 RPM

Presión de trabajo:

125 PSIG (9 baras)

Temperatura máxima:

212°F (100°C) con sello estándar
o 250°F (121°C) con sello
opcional para alta temperatura.

Dirección de rotación:

En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:

Armazón 56J NEMA. 1750 RPM
 1/2 HP. 3500 RPM 1/2 a 5 HP.

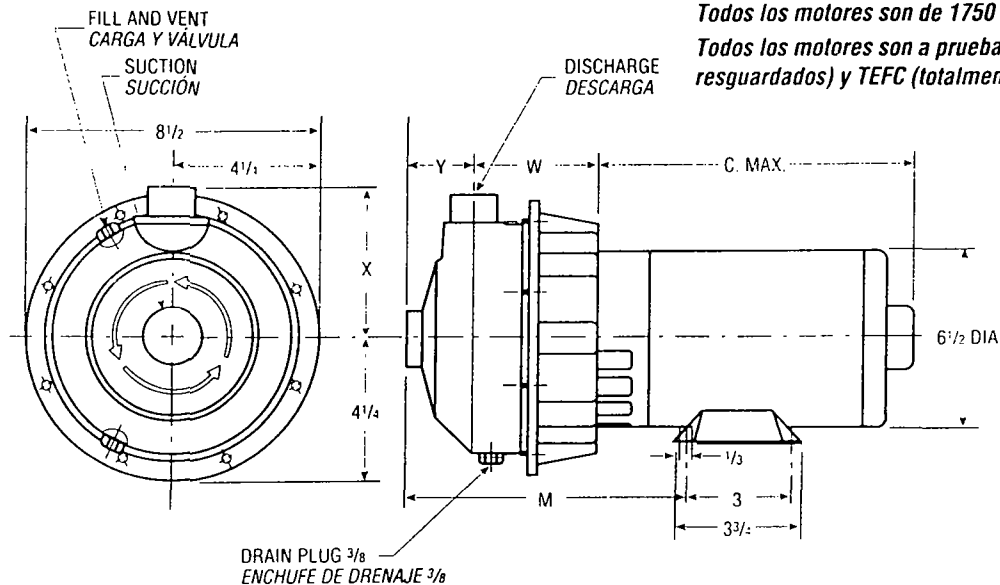
*Cubiertas abiertas resguardadas.
totalmente encerradas enfriadas por
ventilador o a prueba de explosiones
de 2 HP Eje de acero inoxidable con
balineras de bolas.*

Monofásicos: Voltaje 115/230 ODP y TEFC. (modelo 3 HP – 230 voltios solamente) Se proporciona protección térmica contra sobrecarga construida con reseteo automático.

*Tritásicos: Voltaje 208-230/460
ODP, TEFC y EX PROOF.*

NOTA: Para motores trifásicos se debe proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.

NPE Close Coupled with Footed Motor, 1750 RPM and Explosion-proof Motors
NPE Acople Cerrado con Motor con Patas, 1750 RPM y Motores a Prueba de Explosión



All 1750 RPM Motors

All Explosion Proof Motors and 5 HP ODP and TEFC

Todos los motores son de 1750 RPM

Todos los motores son a prueba de explosiones, 5 HP, ODP (abierto, resguardado) y TEFC (totalmente encerrados con enfriamiento forzado)

Dimensions – Determined by Pump,
Dimensiones – Determinadas por la Bomba

Pump, Bomba	Suction, Succión	Discharge, Descarga	HP	W	X	Y	L	M
1ST	1 1/4	1	1/2 – 3	3 3/8	4 3/8	2	4 1/8	7 3/8
2ST	1 1/2	1 1/4	3/4 – 5	3 1/2	4 1/2	2 1/8	5 1/8	7 1/4
3ST	2	1 1/2	1 – 5	3 3/4	4 3/4	2 1/4	5 1/4	7 1/2

Available Motor Weights and Dimensions,
Pesos y Dimensiones Disponibles del Motor

HP	Motor Weights, <i>Pesos del Motor</i>						C Max. Length, (<i>Longitud</i>)
	1 Phase, <i>Monofásicos</i>			3 Phase, <i>Trifásicos</i>			
	ODP	TEFC	EXP	ODP	TEFC	EXP	
½	16	21	47	19	18	27	9¾
¾	19	24	41	21	21	30	10½
1	22	26	49	23	21	30	11
1½	28	35	56	27	27	37	11¾
2	33	39	60	32	33	44	12½
3	40	43	—	41	37	—	12¾
5	42	—	—	42	45	—	14½

Dimensions in inches, weights in pounds.
 Dimensiones en pulgadas, pesos en libras.

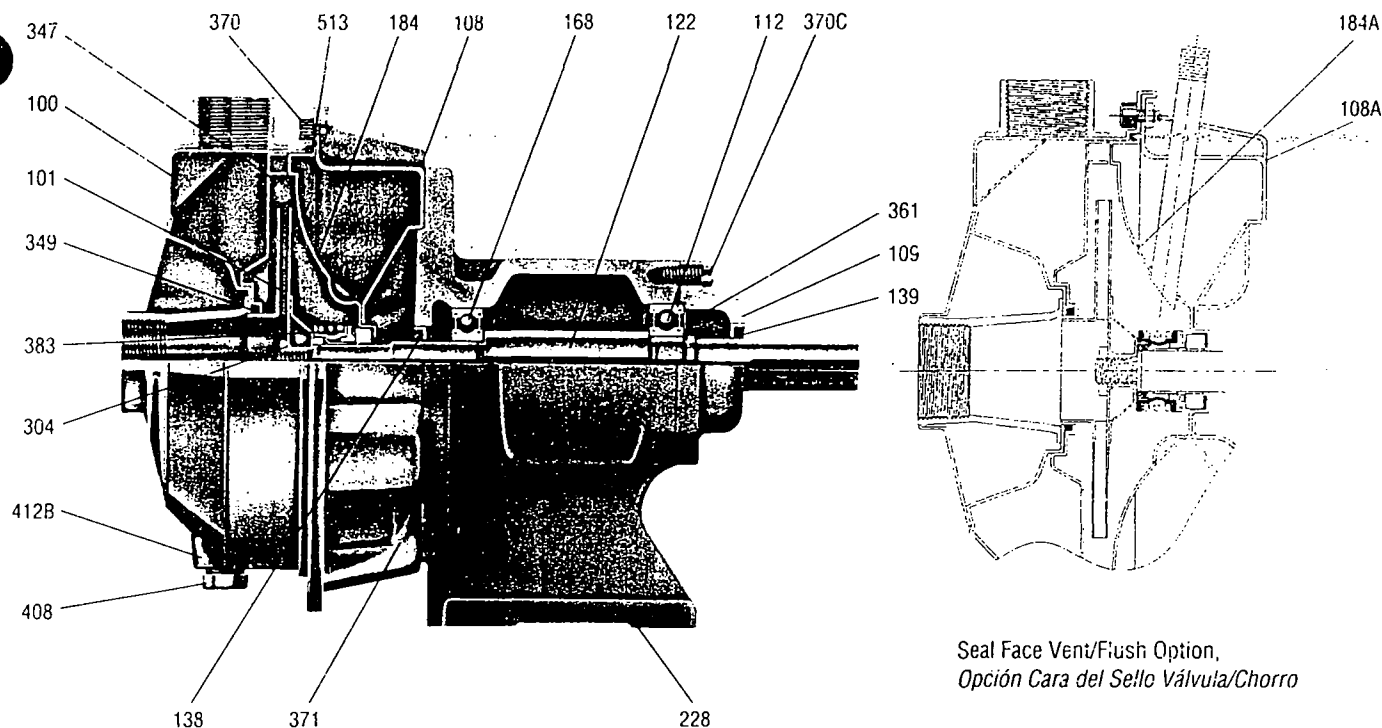
NOTES:

- Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
- Motor dimensions may vary with motor manufacturers.
- Dimensions in inches, weights in pounds.
- For explosion proof motor dimensions consult factory for information.
- Not to be used for construction purposes unless certified.

NOTAS:

- Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.
- Las dimensiones del motor puede que varíen con los fabricantes.
- Dimensiones en pulgadas, pesos en libras.
- Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.
- No usar para propósitos de construcción sin certificar.

NPE Frame Mounted Pump Major Components: Materials of Construction **Bomba NPE de Armazón Montado Componentes Principales: Materiales de Construcción**

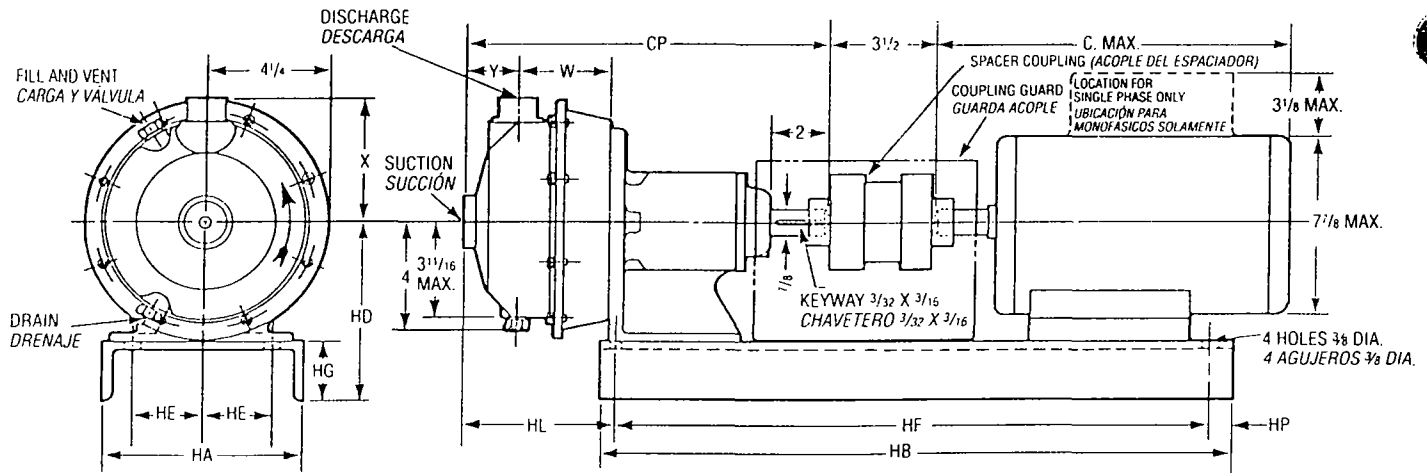


Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., Parte No.	Description, Descripción	Materials, Materiales
100	Casing, Carcasa	
101	Impeller, Impulsor	
108	Adapter, Adaptador	AISI 316L SS, AISI 316L Acero inoxidable
108A	Motor adapter seal vent/flush, Sello válvula/chorro del adaptador del motor	
109	Bearing cover, Cubierta de balineras	Cast iron, Hierro fundido
112	Ball bearing (outboard), Balineras de bolas (exterior)	Steel, Acero
122	Shaft, Eje	AISI 316 SS, AISI 316 Acero inoxidable
138	Lip-seal (inboard), Sello cubierto (interior)	BUNA/steel, BUNA/acero
139	Lip-seal (outboard), Sello cubierto (exterior)	BUNA/steel, BUNA/acero
168	Ball bearing (inboard), Balineras de bolas (interior)	Steel, Acero
184	Seal housing, Alojamiento del sello	AISI 316L SS, AISI 316L Acero inoxidable
184 A	Seal housing seal vent/flush, Sello válvula/chorro del alojamiento del sello	
228	Bearing frame, Armazón de balineras	Cast iron, Hierro fundido

Item No., Parte No.	Description, Descripción	Materials, Materiales
304	Impeller locknut, Contratuerca del impulsor	AISI 316 SS, AISI 316 Acero inoxidable
347	Guidevane, Difusor	
349	Seal ring, guidevane, Anillo del sello, difusor	Viton
361	Retaining ring, Anillo de retención	Steel, Acero
370	Socket head screws, casing; Encaje cabeza del tornillo, carcasa	AISI 410 SS, AISI 410 Acero inoxidable
370C	Hex head screw, bearing cover; Tornillo de cabeza hexagonal, cubierta de balineras	Plated steel, Acero chapeado
371	Hex head screw, bearing frame; Tornillo de cabeza hexagonal, armazón de balineras	Plated steel, Acero chapeado
383	Mechanical seal, Sello mecánico	**see chart, ver tabla
400	Shaft key, Llave del eje	Steel, Acero
408	Drain and vent plug, casing; Enchufes de drenaje y válvula, carcasa	AISI 316 SS, AISI 316 Acero inoxidable
412B	O-ring, drain and vent plug; Anillo 'O', enchufe de drenaje y válvula	Viton
513	O-ring, casing; Anillo 'O', carcasa	

NPE Frame Mounted – Dimensions, Weights and Specifications NPE Armazón Montado – Dimensiones, Pesos y Especificaciones



Specifications Especificaciones

Capacities to:

75 GPM (283L/min) at 1750 RPM
150 GPM (550L/min) at 3500 RPM

Heads to:

39 feet (11 m) at 1750 RPM
150 feet (50 m) at 3500 RPM

Working pressures to:

125 PSIG (9 bars)

Maximum temperatures to:

212°F (100°C) with standard seal
or 250°F (121°C) with optional
high temperature seal.

Direction of rotation:

Clockwise when viewed from
motor end.

Motor specifications:

T-frame single and three phase.
Open drip-proof, TEFC or explosion
proof enclosures are available for
60 Hz, 3500 and 1750 RPM
operation.

For three phase motors, overload
protection must be provided in
starter unit. Starter and heaters must
be ordered separately.

Capacidades:

75 GPM (283L/min) a 1750 RPM
150 GPM (550L/min) a 3500 RPM

Cargas:

39 pies (11 m) a 1750 RPM
150 pies (50 m) a 3500 RPM

Presión de trabajo:

125 PSIG (9 bars)

Temperatura máxima:

212°F (100°C) con sello estándar
o 250°F (121°C) con sello
opcional para alta temperatura.

Dirección de rotación:

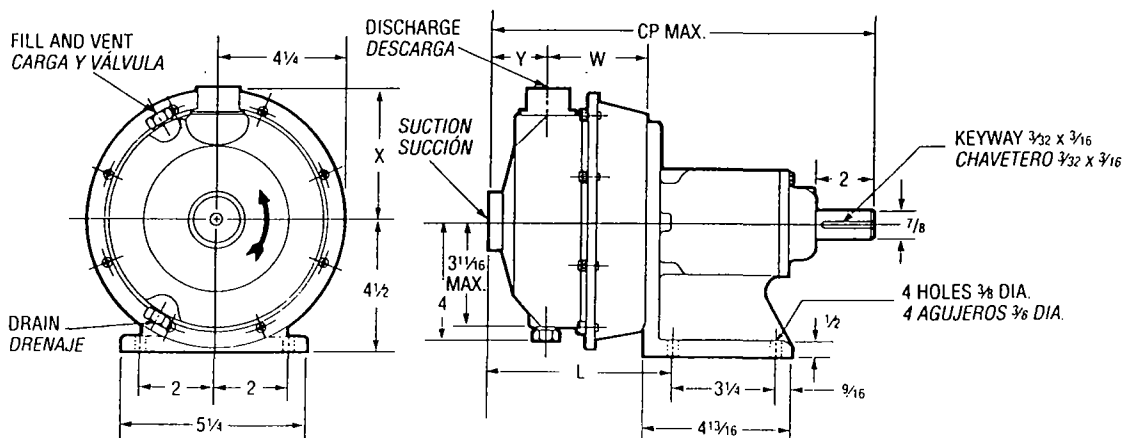
En dirección de las agujas del reloj
visto desde el extremo final del
motor.

Motores:

Armazón T- monofásico y trifásico.
A prueba de goteo, TEFC o recintos a
prueba de explosión están
disponibles para funcionamiento de
60 Hz, 3500 y 1750 RPM.

Para motores trifásicos se debe de
proporcionar la protección térmica
contra sobrecarga en la unidad de
arranque. El arrancador y los
calentadores se deben pedir por
separado.

NPE-F



**Dimensions and Weights – Determined by Pump,
Dimensiones y Pesos – Determinados por la Bomba**

Dim. "HL" Determined
by Pump and Motor,
Dim. "HL"
Determinadas por la
Bomba y el Motor

Pump, Bomba	Suct. NPT, Succión NPT	Disch. NPT, Descarga NPT	CP	L	W	X	Y	Wt., Peso	Frame, Armazón		
									56	140	180
1ST	1¼	1	12 ¹⁵ / ₁₆	6 ⁷ / ₁₆	3 ³ / ₁₆	4 ³ / ₈	2	22½	4 ¹ / ₁₆	6 ¹ / ₁₆	
2ST	1½	1¼	13½	7	3¾	4½	2⅞	23	5⅞	7	
3ST	2	1½				4⅞					

**Available Motor and Bedplate Dimensions and Weights,
Pesos y Dimensiones Disponibles de la Fundación y del Motor**

Motor Frame, Armazón del Motor	HA	HB	HD	HE	HF	HG	HP	Wt. Max., Peso Máx	Shims, Deflector
56									
143T	8	26	6⅞	3⅞	22⅞	2⅞	1	30	1"
145T									
182T	10	26	7¼	3¾	24	2¾	⅞	43	—
184T									

NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.
2. Las dimensiones del motor puede que varíen con los fabricantes.
3. Dimensiones en pulgadas, pesos en libras.
4. Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.
5. No usar para propósitos de construcción sin certificar.

Frame Size, <i>Tamaño del Armazón</i>	Horsepower, <i>Fuerza</i>				C Max.	Wt. Max., <i>Peso Máx.</i>
	3500 RPM					
	Single Phase, <i>Monofásicos</i>		Three Phase, <i>Trifásicos</i>			
	ODP	TEFC	ODP	TEFC		
56	½ – 1½	½ – 1½	½ – 1	½ – 1	13	45
143T	—	—	1½	1½	13⅞	45
145T	2	2	1½ – 3	1½ – 2	14¼	52
182T	3	3	5	3	16⅞	63
184T	5	5	—	5	18⅞	112

Model NPE / 3ST Size (Tamaño) 1½ x 2-6

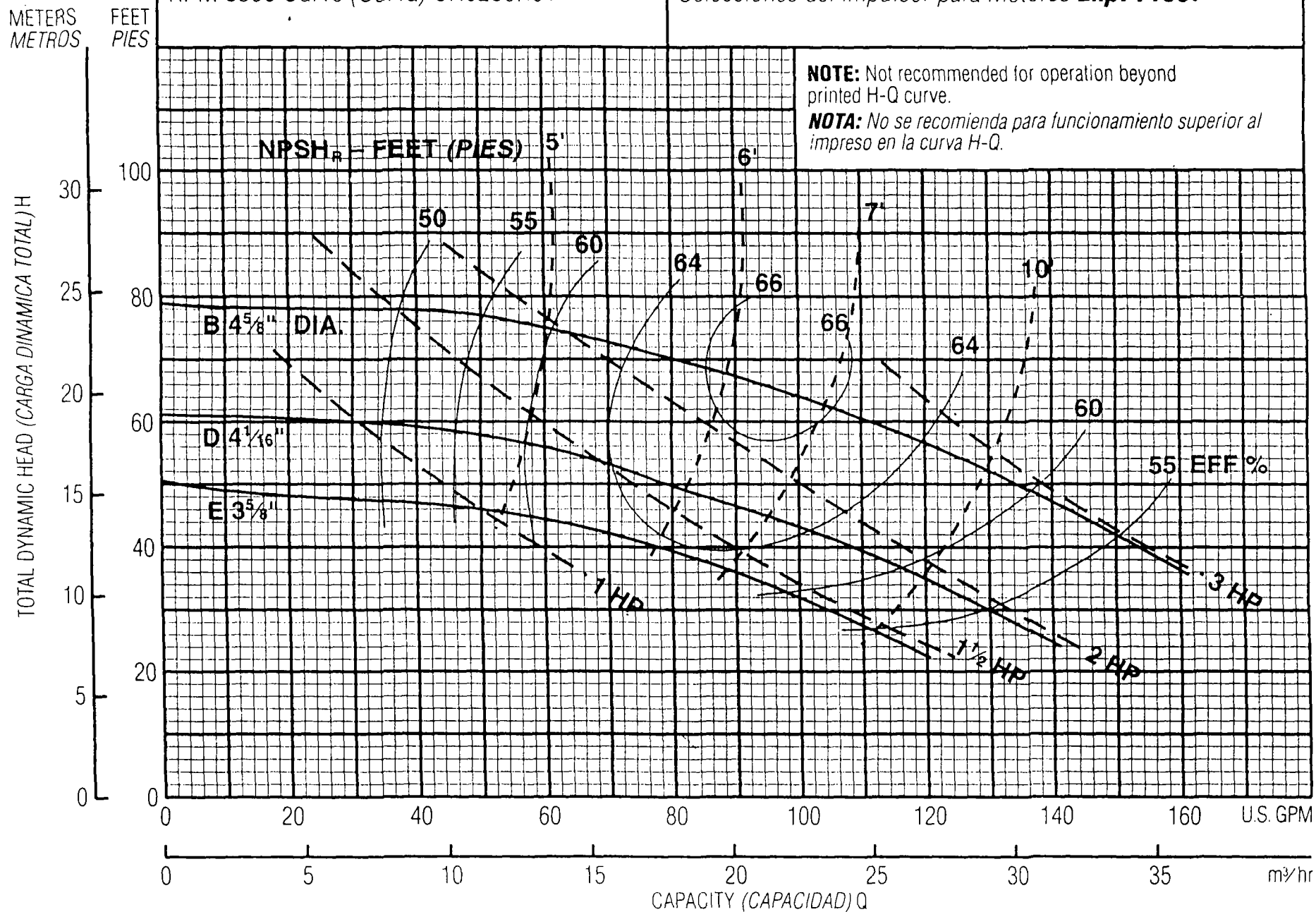
RPM 3500 Curve (Curva) CN0239R01

Impeller Selections for **Exp. Proof** Motors

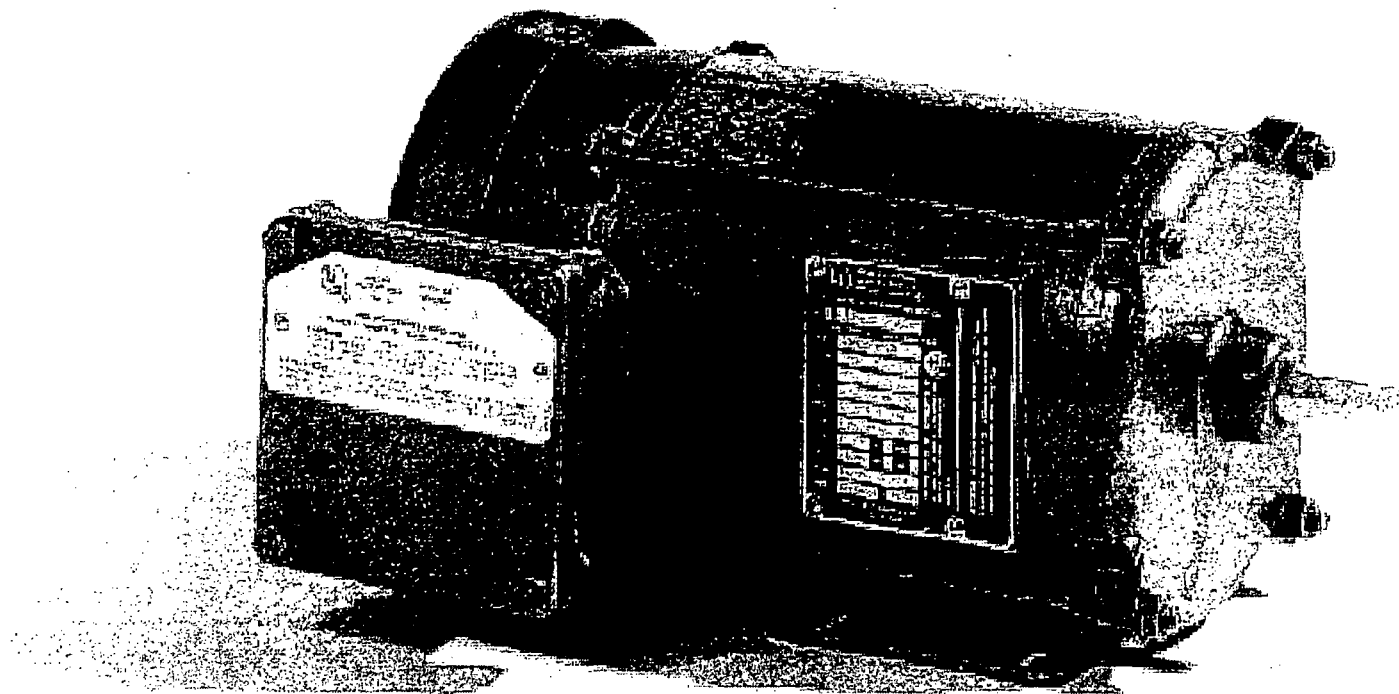
Selecciones del Impulsor para Motores **Exp. Proof**

NOTE: Not recommended for operation beyond printed H-Q curve.

NOTA: No se recomienda para funcionamiento superior al impreso en la curva H-Q.



Catalog Number: L5028T Baldor Electric Company (R)



Performance Data - Winding 36WG0201 Baldor Electric Company (R)

Winding = 36WG0201

RATING - NOMINALS

Rated Output	3
Volts	115/208-230
Full Load Amps	29/15-14.5
Speed	3450
Hertz	60
Phase	1
NEMA Design Code	L
LR KVA Code	G
Efficiency	76.0
Power Factor	87
Service Factor	1.15
Rating - Duty	40C AMB-CONT

CHARACTERISTICS

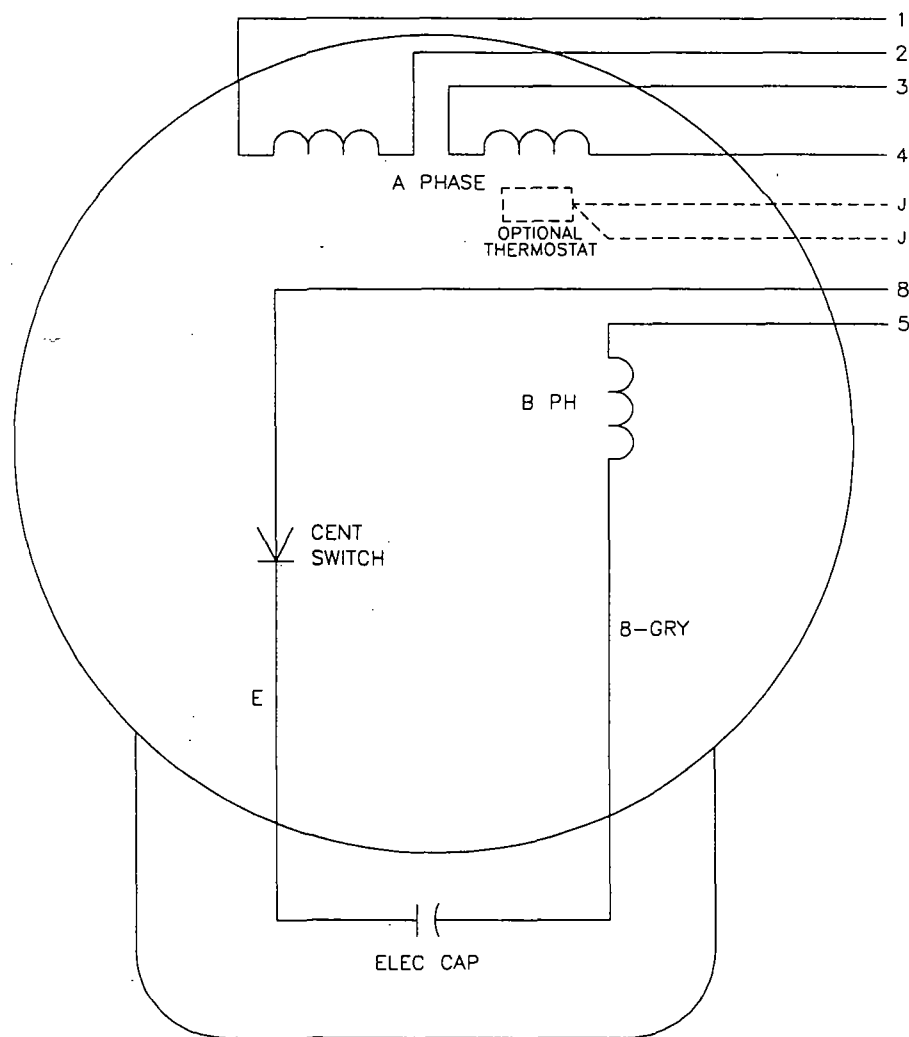
Break Down Torque	14
Locked-Rotor Torque	10
Starting Current	86.0
No-Load Current	5.5
Line-line Resistance @ 25 degrees C	.588
Temperature Rise, in degrees C @ F.L.	

LOAD CHARACTERISTICS - TESTED

% of Rated Load	25	50	75	100	125	150	S.F
Power Factor	70	83	88	91	92	92	92
Efficiency	61.0	71.0	73.5	76.0	75.0	73.0	75.4
Speed (rpm)	3558	3526	3496	3457	3407	3356	3427
Line Amperes	7.00	9.0	11.5	14.5	18.0	21.8	16.60

Connection Diagram for Catalog Number: L5028T - Baldor Electric Company (R)

CD0001



	LINE A	LINE B	JOIN
HIGH STD	1	4,5	2,3,8
HIGH OPP	1	4,8	2,3,5
LOW STD	1,3,8	2,4,5	-
LOW OPP	1,3,5	2,4,8	-

NOTES:

1. STANDARD ROTATION IS CCW FACING END OPPOSITE SHAFT EXTENSION.
2. OPTIONAL THERMOSTAT IS PROVIDED WHEN SPECIFIED.
3. MULTIPLE CAPACITORS ARE CONNECTED IN PARALLEL UNLESS OTHERWISE SPECIFIED.

FS,WS

MATL: -

REV: C MOVE TO AUTOCAD

100000

SCALE: -

BY: JLP

REVISED: 12/29/93

FILE: AAA00007405

TDR: 0050803

BALDOR ELECTRIC Co.

TYPE L, DV, REV, 6 LEADS

CD0001

Installation, Operation and Maintenance Instructions

Model NPE/ NPE-F

DESCRIPTION & SPECIFICATIONS:

The Models NPE (close-coupled) and NPE-F (frame-mounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 316 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

1. Important:

- 1.1. Inspect unit for damage. Report any damage to carrier/dealer immediately.
- 1.2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per National and Local electrical codes. Install an all-leg disconnect switch near pump.

CAUTION

Always disconnect electrical power when handling pump or controls.

- 1.3. Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.

- 1.4. Always use horsepower-rated switches, contactor and starters.

1.5. Motor Protection

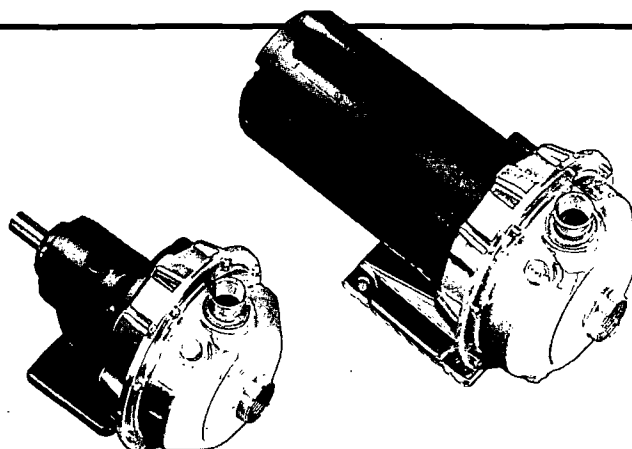
1.5.1. Single-phase: Thermal protection for single-phase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.

1.5.2. Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.

1.6. Maximum Operating Limits:

Liquid Temperature:	212° F (100° C) with standard seal. 250° F (120° C) with optional high temp seal.
Pressure:	75 PSI.
Starts Per Hour:	20, evenly distributed.

- 1.7. Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.



2. Installation:

2.1. General

- 2.1.1. Locate pump as near liquid source as possible (below level of liquid for automatic operation).
- 2.1.2. Protect from freezing or flooding.
- 2.1.3. Allow adequate space for servicing and ventilation.
- 2.1.4. All piping must be supported independently of the pump, and must "line-up" naturally.

CAUTION

Never draw piping into place by forcing the pump suction and discharge connections.

- 2.1.5. Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.

2.2. Close-Coupled Units:

- 2.2.1. Units may be installed horizontally, inclined or vertically.

CAUTION

Do not install with motor below pump. Any leakage or condensation will affect the motor.

- 2.2.2. Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.

- 2.2.3. Tighten motor hold-down bolts before connecting piping to pump.

2.3. Frame-Mounted Units:

- 2.3.1. It is recommended that the bedplate be grouted to a foundation with solid footing. Refer to Fig. 1.

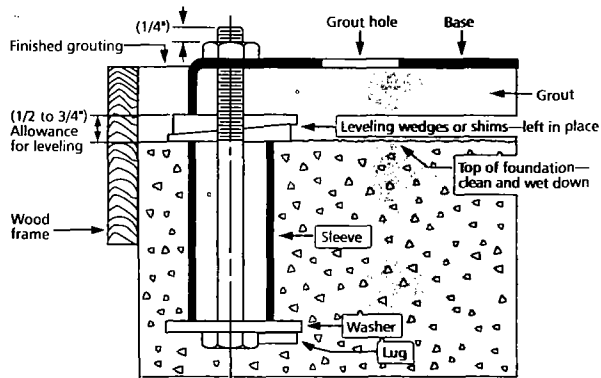


Figure 1

Goulds Pumps

2.3.2. Place unit in position on wedges located at four points (two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.

2.3.3. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.

2.3.4. Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.

2.3.5. Tighten pump and motor hold-down bolts before connecting the piping to pump.

3. Suction Piping:

3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.

3.2. Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.

3.3. If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.

3.4. Installation with pump below source of supply:

3.4.1. Install full flow isolation valve in piping for inspection and maintenance.

CAUTION

Do not use suction isolation valve to throttle pump.

3.5. Installation with pump above source of supply:

3.5.1. Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.

3.5.2. All joints must be airtight.

3.5.3. Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.

3.5.4. Suction strainer open area must be at least triple the pipe area.

3.6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figs. 2-5

3.7. Use 3-4 wraps of Teflon tape to seal threaded connections.

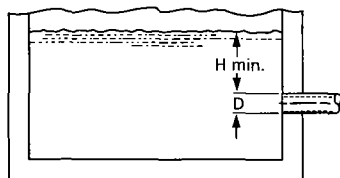


Figure 2

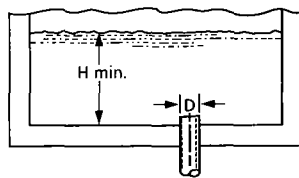


Figure 3

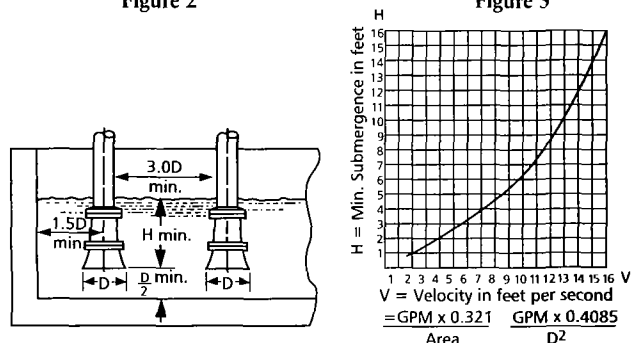


Figure 4

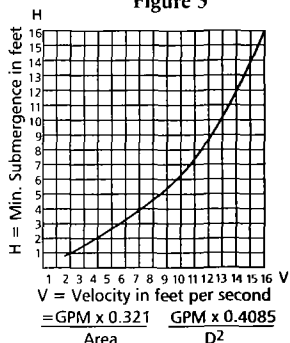


Figure 5

4. Discharge Piping:

4.1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.

4.2. If an increaser is required, place between check valve and pump.

4.3. Use 3-4 wraps of Teflon tape to seal threaded connections.

5. Motor-To-Pump Shaft Alignment:

5.1. Close-Coupled Units:

5.1.1. No field alignment necessary.

5.2. Frame-Mounted Units:

5.2.1. Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Fig. 6.

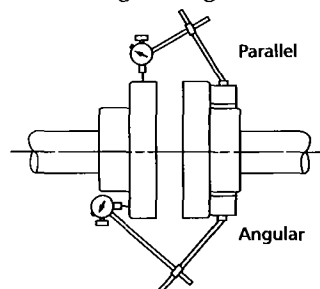


Figure 6

5.2.2. Tighten all hold-down bolts before checking the alignment.

5.2.3. If re-alignment is necessary, always move the motor. Shim as required.

5.2.4. Parallel misalignment - shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.

5.2.5. Angular misalignment - shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.

5.2.6. Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

CAUTION

Always recheck both alignments after making any adjustment.

6. Rotation:

6.1. Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:

6.1.1. Single-phase motor: Non-reversible.

6.1.2. Three-phase motor: Interchange any two power supply leads.

7. Operation:

7.1. Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

CAUTION

Pumped liquid provides lubrication. If pump is run dry, rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.

7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

8. Maintenance:

8.1. Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.

8.2. Frame-Mounted Units:

8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.

8.2.2. Follow motor and coupling manufacturers' lubrication instructions.

8.2.3. Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

9. Disassembly:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

9.1. Turn off power.

9.2. Drain system. Flush if necessary.

9.3. Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

9.4. Disassembly of Liquid End:

9.4.1. Remove casing bolts (370).

9.4.2. Remove back pull-out assembly from casing (100).

9.4.3. Remove impeller locknut (304).

CAUTION

Do not insert screwdriver between impeller vanes to prevent rotation of close-coupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.

9.4.4. Remove impeller (101) by turning counter-clockwise when looking at the front of the pump. Protect hand with rag or glove.

CAUTION

Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.

9.4.5. With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.

9.4.6. Push out the mechanical seal stationary seat from the motor side of the seal housing.

9.5. Disassembly of Bearing Frame:

9.5.1. Remove bearing cover (109).

9.5.2. Remove shaft assembly from frame (228).

9.5.3. Remove lip seals (138 & 139) from bearing frame and bearing cover if worn and are being replaced.

9.5.5. Use bearing puller or arbor press to remove ball bearings (112 & 168).

10. Reassembly:

10.1. All parts should be cleaned before assembly.

10.2. Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.

10.3. Reassembly is the reverse of disassembly.

10.3.1. Impeller and impeller locknut assembled onto motor shaft with 10 ft-lbs of torque.

10.4. Observe the following when reassembling the bearing frame:

10.4.1. Replace lip seals if worn or damaged.

10.4.2. Replace ball bearings if loose, rough or noisy when rotated.

10.4.3. Check shaft for runout. Maximum permissible is .002" T.I.R.

10.5. Observe the following when reassembling the liquid-end:

10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

10.5.2. Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.

10.5.3. Inspect guidevane O-ring (349) and replace if worn.

CAUTION

Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.

10.6. Check reassembled unit for binding. Correct as required.

10.7. Tighten casing bolts in a star pattern to prevent O-ring binding.

11. Trouble Shooting Chart:

MOTOR NOT RUNNING

(See causes 1 thru 6)

LITTLE OR NO LIQUID DELIVERED:

(See causes 7 thru 17)

POWER CONSUMPTION TOO HIGH:

(See causes 4, 17, 18, 19, 22)

EXCESSIVE NOISE AND VIBRATION:

(See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

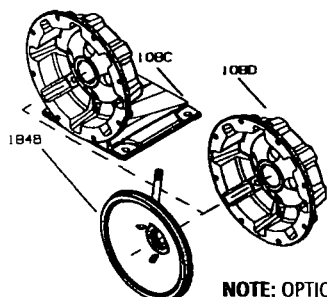
PROBABLE CAUSE:

1. Tripped thermal protector
2. Open circuit breaker
3. Blown fuse
4. Rotating parts binding
5. Motor wired improperly
6. Defective motor
7. Not primed
8. Discharge plugged or valve closed
9. Incorrect rotation
10. Foot valve too small, suction not submerged, inlet screen plugged.
11. Low voltage
12. Phase loss (3-phase only)
13. Air or gasses in liquid
14. System head too high
15. NPSHA too low:
Suction lift too high or suction losses excessive.
Check with vacuum gauge.
16. Impeller worn or plugged
17. Incorrect impeller diameter
18. Head too low causing excessive flow rate
19. Viscosity or specific gravity too high
20. Worn bearings
21. Pump or piping loose
22. Pump and motor misaligned

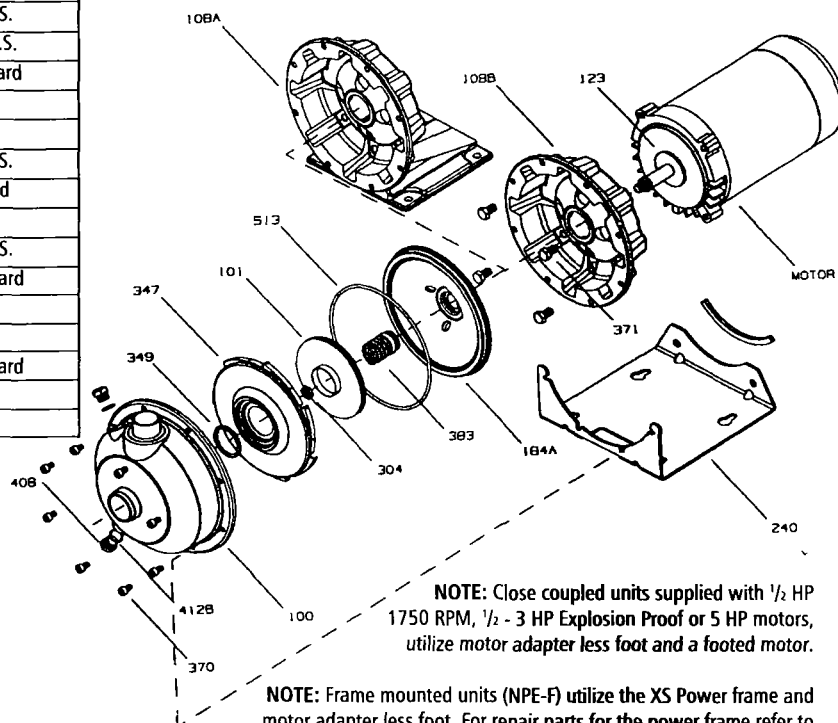
NPE Standard Repair Parts List

Item No.	Description	Materials of Construction
100	Casing	AISI 316L Stainless Steel
101	Impeller	
108A	Motor adapter with foot	
108B	Motor adapter less foot	
108C	Motor adapter with foot and Flush	
108D	Motor adapter less foot with Flush	BUNA-N
123	Deflector	
184A	Seal housing std.	AISI 316L S.S.
184B	Seal housing with seal flush	
240	Motor support	300 S.S.
	Rubber channel	Rubber
304	Impeller locknut	AISI 316 S.S.
347	Guidevane	AISI 316L S.S.
349	Seal-Ring, guidevane	Viton Standard
		EPR
		BUNA
370	Socket head screw, casing	AISI 410 S.S.
371	Bolts, motor	Steel/plated
383	Mechanical seal	AISI 316 S.S.
408	Drain and vent plug, casing	
412B	O-Ring, drain plugs	Viton, standard
		EPR
		BUNA
513	O-Ring, casing	Viton, standard
		EPR
		BUNA

Item 383 Mechanical Seal (1/4" seal)				
Rotary	Stationary	Elastomers	Metal Parts	Part No.
Carbon	Sil-Carbide	EPR	316SS	10K18
		Viton		10K55
Sil-Carbide		EPR		10K81
		Viton		10K62



NOTE: OPTIONAL SEAL FLUSH COMPONENTS



NOTE: Close coupled units supplied with 1/2 HP 1750 RPM, 1/2 - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

NOTE: Frame mounted units (NPE-F) utilize the XS Power frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61

GOULDS PUMPS LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

The warranty excludes:

- Labor, transportation and related costs incurred by the dealer;
- Reinstallation costs of repaired equipment;
- Reinstallation costs of replacement equipment;
- Consequential damages of any kind; and,
- Reimbursement for loss caused by interruption of service.

For purposes of this warranty, the following terms have these definitions:

- "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
- "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
- "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

THIS WARRANTY EXTENDS TO THE DEALER ONLY.

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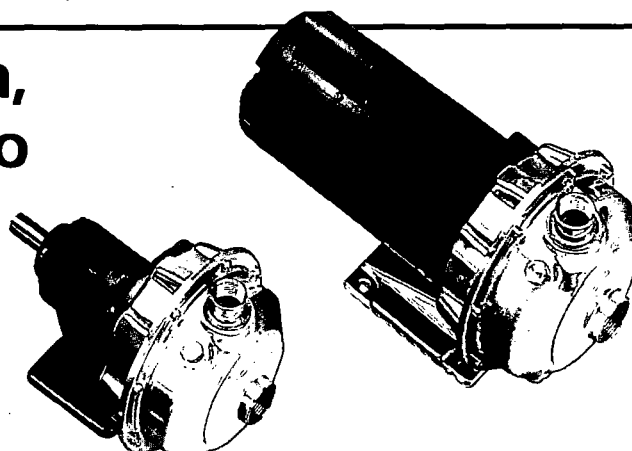
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Goulds Pumps



Instrucciones De Instalación, Operación Y Mantenimiento

Modelo NPE/NPE-F



DESCRIPCIÓN Y ESPECIFICACIONES:

Los modelos NPE (compacto) y NPE-F (montado en marco) son bombas centrífugas de una etapa, de succión axial para el servicio de transferencia de líquidos en general, aplicaciones de refuerzo de presión, etc. La construcción del extremo sumergido es toda de AISI (Instituto Norteamericano del Hierro y el Acero) de acero inoxidable Tipo 316, estampada y soldada. Los impulsores son totalmente cerrados, y no se pueden recortar a diámetros intermedios. Las carcasas están equipadas con un difusor para eficiencia y que las cargas radiales sean negligibles en el eje.

Las unidades compactas tienen motores NEMA 48J o 561, con montaje de cara C y extensión roscada del eje. Las unidades montadas en marco se pueden acoplar a los motores a través de un espaciador de acoplamiento, o ser accionadas por correa.

1. Importante:

1.1. Inspeccione si la unidad tiene daños. Informe inmediatamente de cualquier daño al transportista o al agente.

1.2. La alimentación eléctrica debe ser un circuito separado con los fusibles o interruptores automáticos, tamaños de alambres, etc., de acuerdo con los Códigos Eléctricos Nacional y Local. Instale un interruptor de desconexión en todos los alambres cerca de la bomba.

PRECAUCIÓN

Siempre desconecte la corriente eléctrica cuando maneje la bomba o los controles.

1.3. El cableado de los motores debe ser adecuado para la tensión. El diagrama del cableado del motor está en la placa del fabricante del motor. El tamaño de los alambres debe limitar la máxima caída de tensión al 10% de la tensión de la placa del fabricante en los terminales del motor, o la vida del motor y el rendimiento de la bomba se disminuirán.

1.4. Siempre use interruptores, contactores y arrancadores con clasificación de potencia nominal.

1.5. Protección del motor

1.5.1. Monofásico: La protección térmica en las unidades monofásicas a veces está incorporada (verifique la placa del fabricante). Si no se provee protección incorporada, use un contactor con la sobrecarga apropiada. Se permite usar fusible.

1.5.2. Trifásico: proporcione protección en los tres alambres con arrancador magnético de tamaño apropiado y sobrecargas térmicas.

1.6. Límites máximos de operación:

Temperatura del líquido: 212° F (100° C) con sello estándar.
250° F (120° C) con sello de alta temperatura opcional.

Presión: 75 lib/pulg².

Arranques por hora: 20, distribuidos uniformemente.

1.7. La inspección y el mantenimiento regular aumentarán la vida de servicio. Establezca el programa de acuerdo al tiempo de funcionamiento. Refiérase a la Sección 8.

2. Instalación:

2.1. Generalidades

2.1.1. Coloque la bomba tan cerca de la fuente del líquido como sea posible (debajo del nivel del líquido para operación automática).

2.1.2. Proteja de la congelación o inundación.

2.1.3. Deje espacio libre adecuado para el servicio y la ventilación.

2.1.4. Toda la tubería debe estar soportada independientemente de la bomba, y debe "estar alineada" naturalmente.

PRECAUCIÓN

Nunca estire la tubería en el lugar forzando las conexiones de la succión y descarga de la bomba.

2.1.5. Evite los accesorios innecesarios. Seleccione los tamaños para mantener las pérdidas de fricción al mínimo.

2.2. Unidades compactas:

2.2.1. Estas unidades pueden instalarse horizontalmente, inclinadas o verticalmente.

PRECAUCIÓN

No instale con el motor debajo de la bomba. Cualquier fuga o condensación afectará al motor.

2.2.2. La cimentación debe ser plana y substancial para eliminar las deformaciones cuando se aprieten los pernos. Use montajes de goma para minimizar el ruido y las vibraciones.

2.2.3. Apriete los pernos de sujeción del motor antes de conectar la tubería a la bomba.

2.3. Unidades montadas en marco:

2.3.1. Se recomienda enlechar la plancha de asiento a un cimiento con zapata sólida. Vea la Fig. 1.

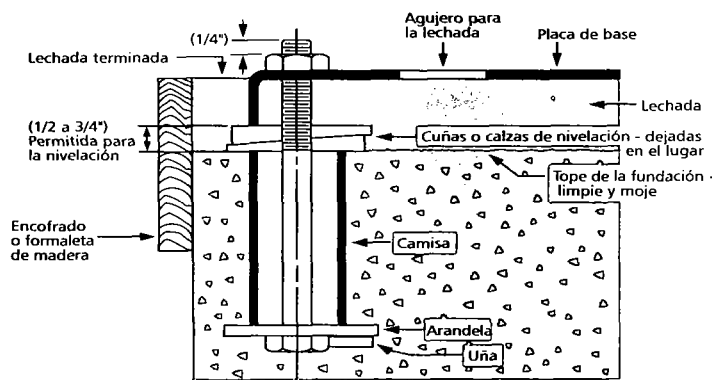


Figura Goulds Pumps

2.3.2. Coloque la unidad en posición sobre las cuñas ubicadas en cuatro puntos, (dos aproximadamente debajo del centro del motor y dos aproximadamente debajo del centro de la bomba). Ajuste las cuñas para nivelar la unidad. Nivele o ponga vertical las bridas de succión y de descarga.

2.3.3. Asegúrese de que la placa de base no esté distorsionada y se pueda hacer la alineación final del acoplamiento dentro de los límites del movimiento del motor y poniendo calzas, si fuera necesario.

2.3.4. Apriete con los dedos los pernos de la cimentación y construya la presa alrededor de la cimentación. Vierta la lechada debajo de la placa de base asegurándose de que las áreas debajo de la bomba y de la pata del motor estén bien rellenas. Deje que la lechada fragüe por 48 horas antes de apretar totalmente los pernos de la cimentación.

2.3.5. Apriete los pernos de sujeción de la bomba y del motor antes de conectar la tubería a la bomba.

3. Tubería de succión:

3.1. Es deseable tener una tubería de succión directa, corta y una altura de aspiración estática baja. Para alturas de succión superiores a 10 pies y temperaturas del líquido superiores a 120° F, consulte la curva de rendimiento de la bomba para ver la Altura de Succión Positiva Neta requerida.

3.2. La tubería de succión debe ser por lo menos tan grande como la conexión de succión a la bomba. Un tamaño más pequeño disminuirá el rendimiento.

3.3. Si se requiere una tubería más grande, se debe instalar una reducción excéntrica (con el lado recto hacia arriba), en la bomba.

3.4. Instalación con la bomba abajo de la fuente de alimentación:

3.4.1. Instale en la tubería una válvula de aislación de todo el caudal para la inspección y mantenimiento.

PRECAUCIÓN

No use la válvula de aislación de succión para estrangular la bomba.

3.5. Instalación con la bomba arriba de la fuente de alimentación:

3.5.1. Evite las bolsas de aire. Ninguna de las partes de la tubería debe ser más alta que la conexión de succión de la bomba. Incline la tubería hacia arriba, partiendo de la fuente del líquido.

3.5.2. Todas las juntas deben ser estancas.

3.5.3. La válvula de pie debe usarse solamente si es necesario para el cebado o para mantener el cebado durante el servicio intermitente.

3.5.4. El área abierta del colador de succión debe ser por lo menos el triple del área de la tubería.

3.6. El tamaño de la entrada de la fuente del líquido, y la inmersión mínima sobre la succión, deben ser suficientes para impedir la entrada de aire a la bomba a través de vórtices. Vea las Figuras 2 a 5.

3.7. Use 3 a 4 vueltas de cinta de Teflon para sellar las conexiones roscadas.

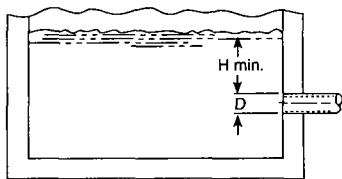


Figura 2

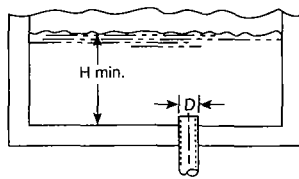


Figura 3

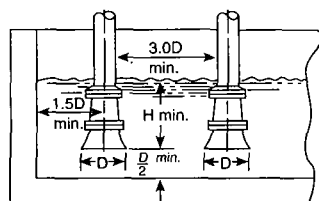


Figura 4

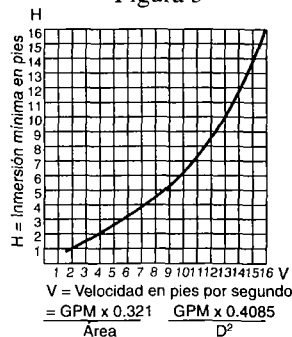


Figura 5

4. Tubería de descarga:

4.1. La disposición debe incluir una válvula de retención ubicada entre una válvula de compuerta y la bomba. La válvula de compuerta es para la regulación de la capacidad o para la inspección de la bomba o de la válvula de retención.

4.2. Si se requiere un aumentador, instale entre la válvula de retención y la bomba.

4.3. Use 3 a 4 vueltas de cinta de Teflón para sellar las conexiones roscadas.

5. Alineación del eje del motor al de la bomba:

5.1. Unidades compactas:

5.1.1. No se necesita alinear en el campo.

5.2. Unidades montadas en marco:

5.2.1. Aunque la unidad del motor y bomba pueda tener una alineación de fábrica, ésta pudo haberse alterado en tránsito y debe verificarse antes de hacer funcionar. Vea la Figura 6.

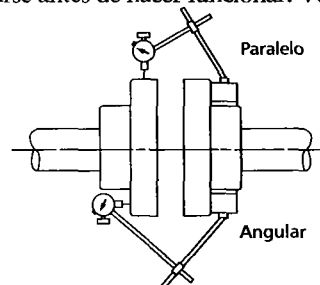


Figura 6

5.2.2. Apriete todos los pernos de sujeción antes de verificar la alineación.

5.2.3. Si es necesario realinear, siempre mueva el motor. Ponga calzas según se requiera.

5.2.4. Mala alineación paralela (ejes con ejes paralelos pero no concéntricos). Ponga el indicador de cuadrante en un cubo y gire este cubo 360° mientras hace lecturas en el diámetro exterior del otro cubo. La alineación paralela se obtiene cuando la lectura indicada total es de 0,005" (0,127 mm) o menos.

5.2.5. Mala alineación angular (ejes con ejes concéntricos pero no paralelos). Ponga el indicador de cuadrante en un cubo y gire este cubo 360° mientras hace lecturas en la cara del otro cubo. La alineación angular se obtiene cuando la lectura indicada total es de 0,005" (0,127 mm) o menos.

5.2.6. La alineación final se obtiene cuando se satisfacen los requerimientos de alineación paralela y angular, con los pernos de sujeción del motor apretados.

PRECAUCIÓN

Siempre vuelva a verificar ambas alineaciones después de hacer cualquier ajuste.

6. Rotación:

6.1. La rotación correcta es a la derecha (en sentido dextrorso cuando se mira desde el extremo del motor). Encienda y apague la corriente rápidamente. Observe la rotación del eje. Para cambiar la rotación:

6.1.1. Motores monofásicos: No reversibles.

6.1.2. Motores trifásicos: Intercambie dos cualesquiera de los conductores de alimentación de potencia.

7. Operación:

7.1. Antes de arrancar, se debe cebar la bomba (la tubería de succión llena de líquido y sin aire), y abrir parcialmente la válvula de descarga.

PRECAUCIÓN

El líquido bombeado proporciona lubricación. Si se hace funcionar la bomba en seco, las partes que giran se agarrotarán y se dañará el sello mecánico. No haga funcionar con caudal muy bajo o cerca de cero. La energía impartida al líquido se convierte en calor y el líquido puede convertirse en vapor. Las partes giratorias requieren líquido para impedir la formación de estrías o el agarrotamiento.

7.2. Haga una verificación completa después de que haya funcionado la unidad bajo condiciones de operación y se haya estabilizado la temperatura. Verifique la expansión de la tubería. En las unidades montadas en marco la alineación del acoplamiento pudo haber cambiado debido a la diferencial de temperatura entre el motor y la bomba. Vuelva a verificar la alineación.

8. Mantenimiento:

8.1. Unidad compacta. Los cojinetes de bolas están colocados adentro y son parte del motor. Están lubricados permanentemente y no requieren engrase.

8.2. Unidades montadas en marco:

8.2.1. El marco del cojinete se debe volver a engrasar cada 2.000 horas o a intervalos de 3 meses, el que ocurra primero. Use una grasa #2 con base de sodio o litio. Llene hasta que la grasa salga de las graseras o de los sellos de reborde, luego limpie el exceso.

8.2.2. Siga las instrucciones de lubricación del fabricante del motor y del acoplamiento.

8.2.3. La alineación se debe volver a verificar después de cualquier trabajo de mantenimiento que implique alguna alteración de la unidad.

9. Desmontaje:

Se describirá el desmontaje completo de la unidad. Prosiga solamente hasta donde se requiera para realizar el trabajo de mantenimiento necesario.

9.1. Apague la alimentación eléctrica.

9.2. Drene el sistema. Lave con chorro, si es necesario.

9.3. Unidades compactas: Quite los pernos de sujeción del motor.

Unidades montadas en marco: Quite el acoplamiento, el espaciador, el resguardo del acoplamiento y los pernos de sujeción del marco.

9.4. Desmontaje del extremo sumergido:

9.4.1. Quite los pernos (370) de la carcasa.

9.4.2. Quite el conjunto de desmontaje de la caja de rodamientos de la carcasa (100).

9.4.3. Quite la tuerca de seguridad (304) del impulsor.

PRECAUCIÓN

No inserte un destornillador entre los álabes del impulsor para impedir la rotación de las unidades compactas. Quite la tapa en el lado opuesto del motor. Se expondrá una ranura del destornillador o un par de filos normales al eje. Usándolos impedirá daños al impulsor.

9.4.4. Quite el impulsor (101) girando en sentido sinistrorso mirando al frente de la bomba. Protéjase las manos con telas o guantes.

PRECAUCIÓN

No quitar el impulsor en sentido sinistrorso puede dañar las roscas en el impulsor, el eje o en ambos.

9.4.5. Con dos barras de hacer palanca separadas en 180 grados e insertadas entre el alojamiento del sello (184) y el adaptador del motor (108), cuidadosamente separe las dos partes. La unidad giratoria del sello mecánico (383) debe salir del eje con el alojamiento del sello.

9.4.6. Empuje afuera el asiento estacionario del sello mecánico, del lado del motor del alojamiento del sello.

9.5. Desmontaje del marco del cojinete:

9.5.1. Quite la tapa (109) del cojinete.

9.5.2. Quite el conjunto del eje del marco (228).

9.5.3. Quite los sellos de reborde (138 y 139) del marco del cojinete y de la tapa del cojinete si están desgastados y se están cambiando.

9.5.5. Use un extractor de cojinetes o prensa de eje para quitar los cojinetes de bolas (112 y 168).

10. Reensamble:

10.1. Todas las piezas deben limpiarse antes del montaje.

10.2. Consulte la lista de piezas para identificar las piezas necesarias para la reparación. Especifique la bomba o el número de catálogo cuando pida las piezas.

10.3. Reensamblar o volver a montar es lo contrario de desmontar.

10.3.1. El impulsor y la contratuerca del impulsor se instalan en el eje del motor con una torsión de 10 pie-lbs.

10.4. Observe lo siguiente cuando vuelva a montar el marco del cojinete:

10.4.1. Cambie los sellos de reborde si están desgastados o dañados.

10.4.2. Cambie los cojinetes de bolas si están flojos, ásperos o ruidosos al girarlos.

10.4.3. Verifique si el eje está descentrado. El máximo permisible es una lectura de indicador total de 0,002".

10.5. Observe lo siguiente cuando vuelva a montar el extremo sumergido:

10.5.1. Todos los componentes del sello mecánico deben estar en buenas condiciones o pueden haber fugas. Es buena práctica estándar cambiar todo el conjunto del sello en cualquier momento en que se haya quitado el sello.

Se permite usar un lubricante ligero, tal como glicerina, para facilitar el montaje. No contamine las caras del sello mecánico con lubricante.

10.5.2. Inspeccione el anillo en O (513) de la carcasa y cámbielo si está dañado. Este anillo en O puede lubricarse con vaselina para facilitar el montaje.

10.5.3. Inspeccione el anillo en O (349) del álabe director y cámbielo si está desgastado.

PRECAUCIÓN

No lubrique el anillo en O (349) del álabe director. Asegúrese de que no esté pellizcado por el impulsor al volver a montar.

10.6. Verifique la unidad que volvió a montarse viendo si está agarrotada. Corrija según se requiera.

10.7. Apriete los pernos de la carcasa en un patrón de estrella para impedir que se trabe el anillo en O.

11. Investigación de averías:

MOTOR NO FUNCIONA:

(Vea las causas 1 a 6)

ENTREGA POCO O NADA DE LÍQUIDO:

(Vea las causas 7 a 17)

CONSUMO MUY ALTO DE CORRIENTE:

(Vea las causas 4, 17, 18, 19, 22)

EXCESIVO RUIDO Y VIBRACIONES:

(Vea las causas 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

CAUSA PROBABLE:

1. Protector térmico del motor disparado

2. Interruptor automático abierto

3. Fusible quemado

4. Partes giratorias agarrotadas

5. Motor mal conectado

6. Motor defectuoso

7. Bomba no cebada

8. Taponada la descarga o cerrada la válvula

9. Rotación incorrecta

10. Válvula de pie demasiado pequeña, succión no sumergida, taponada la malla de entrada.

11. Tensión baja

12. Pérdida de fase (trifásico solamente)

13. Aire o gases en el líquido

14. Demasiado alta la altura o carga del sistema

15. Demasiado baja la ASPN_D; (altura de succión positiva neta disponible);

Demasiado alta la altura de aspiración o excesivas las pérdidas. Verifique con un calibrador de vacío.

16. Impulsor desgastado o taponado

17. Incorrecto el diámetro del impulsor

18. Demasiado baja la altura de descarga causando caudal excesivo

19. Demasiado alta la viscosidad o gravedad específica

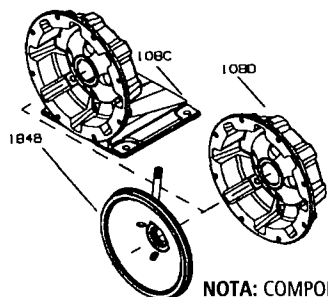
20. Cojinetes desgastados

21. Bomba o tubería flojas

22. Bomba y motor mal alineados

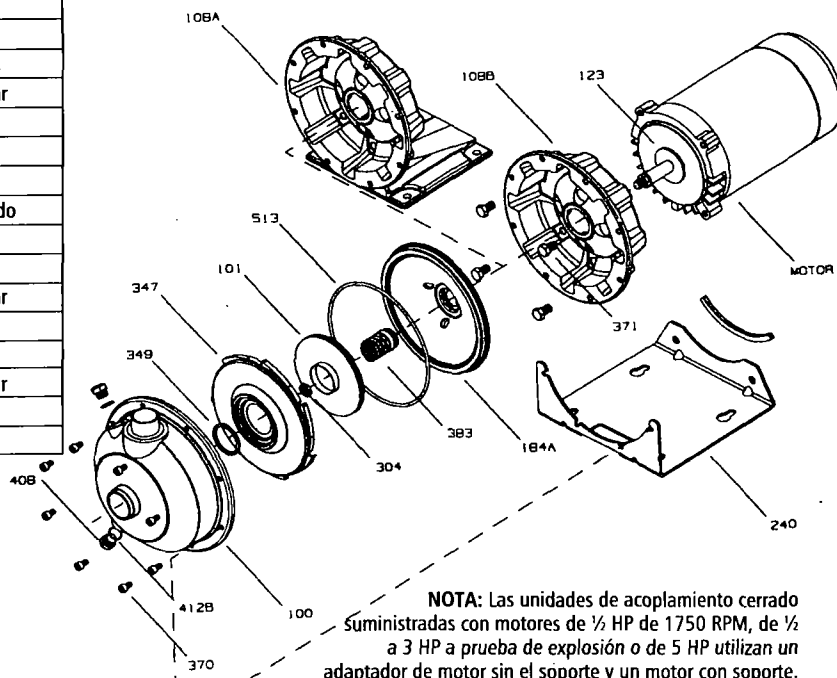
Lista de repuestos estándar NPE

Pieza No.	Descripción	Materiales de Construcción
100	Carcasa	Acero inoxidable AISI 3161
101	Impulsor	
108A	Adaptador del motor con soporte	
108B	Adaptador del motor sin soporte	
108C	Adaptador del motor con soporte y a ras	
108D	Adaptador del motor sin soporte a ras	BUNA-N
123	Deflector	
184A	Caja del sello, estándar	AISI 316L S.S.
184B	Caja del sello con sello a ras	
240	Apoyo para el motor	300 S.S.
	Canal de caucho	Caucho
304	Contratuera del impulsor	AISI 316 S.S.
347	Álabe de guía	AISI 316L S.S.
349	Anillo de sellado, álabe de guía	Viton, estándar
		EPR
		BUNA
370	Tornillo de cabeza hueca, carcasa	AISI 410 S.S.
371	Pernos, del motor	Acero/enchapado
383	Sello mecánico	
408	Tapón de drenaje y venteo, carcasa	AISI 316 S.S.
412B	Anillo en O, tapón de drenaje	Viton, estándar
		EPR
		BUNA
513	Anillo en O, carcasa	Viton, estándar
		EPR
		BUNA



NOTA: COMPONENTES OPCIONALES DEL SELLO A RAS

Art. 383 Sellos mecánicos (sello de 5/8")				
Giratorio	Estacionario	Elastómeros	Partes Metálicas	Pieza No.
Carbono	Carbono de silicio	EPR	316SS	10K18
		Viton		10K55
Carbono de silicio		EPR		10K81
		Viton		10K62



NOTA: Las unidades de acoplamiento cerrado suministradas con motores de 1/2 HP de 1750 RPM, de 1/2 a 3 HP a prueba de explosión o de 5 HP utilizan un adaptador de motor sin el soporte y un motor con soporte.

NOTA: Las unidades montadas sobre bastidor (NPE-F) utilizan el bastidor XS Power y un adaptador de motor sin soporte. Con respecto a repuestos para el bastidor mecánico, consulte la página de repuestos para bastidor XS-Power en la sección de partes de su catálogo. Para ordenar el bastidor mecánico completo, pida el artículo 14L61.

GARANTÍA LIMITADA DE GOULDS PUMPS

Esta garantía es aplicable a todas las bombas para sistemas de agua fabricadas por Goulds Pumps.

Toda parte o partes que resulten defectuosas dentro del período de garantía serán reemplazadas sin cargo para el comerciante durante dicho período de garantía. Tal período de garantía se extiende por doce (12) meses a partir de la fecha de instalación, o dieciocho (18) meses a partir de la fecha de fabricación, cualquiera se cumpla primero.

Todo comerciante que considere que existe lugar a un reclamo de garantía deberá ponerse en contacto con el distribuidor autorizado de Goulds Pumps del cual adquiriera la bomba, y ofrecer información detallada con respecto al reclamo. El distribuidor está autorizado a liquidar todos los reclamos por garantía a través del Departamento de Servicios a Clientes de Goulds Pumps.

La presente garantía excluye:

- La mano de obra, el transporte y los costos relacionados en los que incurra el comerciante;
- los costos de reinstalación del equipo reparado;
- los costos de reinstalación del equipo reemplazado;
- daños emergentes de cualquier naturaleza; y
- el reembolso de cualquier pérdida causada por la interrupción del servicio.

A los fines de esta garantía, los términos "Distribuidor", "Comerciante" y "Cliente" se definen como sigue:

- "Distribuidor" es aquel individuo, sociedad, corporación, asociación u otra entidad jurídica que opera entre Goulds Pumps y el comerciante para la compra, consignación o contratos de venta de las bombas en cuestión.
- "Comerciante" es todo individuo, sociedad, corporación, asociación u otra entidad jurídica que realiza negocios de venta o alquiler-venta (leasing) de bombas a clientes.
- "Cliente" es toda entidad que compra o que adquiere bajo la modalidad de leasing las bombas en cuestión de un comerciante. El término "cliente" puede significar un individuo, una sociedad, una corporación, una sociedad de responsabilidad limitada, una asociación o cualquier otra entidad jurídica con actividades en cualquier tipo de negocios.

LA PRESENTE GARANTÍA SE EXTIENDE AL COMERCIANTE ÚNICAMENTE

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Goulds Pumps



Directives d'installation, d'utilisation et d'entretien

Modèles NPE et NPE-F

DESCRIPTION ET CARACTÉRISTIQUES

Les pompes modèles NPE monobloc (sur moteur) et NPE-F (sur palier) sont des pompes centrifuges à un étage et à orifice d'aspiration en bout, utilisées pour le transfert général de liquides, l'augmentation de pression, etc. La tête de pompage est tout en inox AISI du type 316 estampé ou soudé. La roue, fermée, ne peut être réduite à un diamètre moindre par usinage. Le corps de pompe est muni d'un diffuseur pour en améliorer le rendement et diminuer la charge radiale de l'arbre.

Les NPE sont montées sur des moteurs NEMA 48J ou 56J à bride de fixation en C et à bout d'arbre fileté. Les pompes montées sur palier peuvent être entraînées par accouplement ou par courroie.

1. Informations importantes

- 1.1. Inspecter l'appareil et signaler immédiatement tout dommage au transporteur ou au détaillant.
- 1.2. L'alimentation en électricité doit être assurée par un circuit de dérivation distinct dont les fusibles ou les disjoncteurs, le calibre des fils, etc. sont conformes aux prescriptions du code provincial ou national de l'électricité. Poser un sectionneur tout conducteur près de la pompe.

ATTENTION

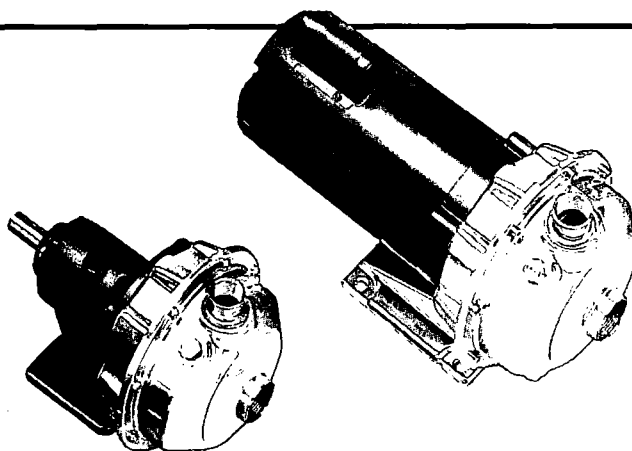
On doit toujours couper le courant lorsque l'on effectue quelque travail que ce soit sur la pompe ou les commandes.

- 1.3. Le câblage d'alimentation du moteur doit convenir à la tension de fonctionnement. Le schéma de câblage se trouve sur la plaque signalétique du moteur. Les fils doivent avoir un calibre limitant la chute de tension maximale, aux bornes du moteur, à 10 % de la valeur de tension indiquée sur la plaque signalétique, sinon la durée de vie du moteur et les performances de la pompe diminueront.
- 1.4. Il faut toujours employer des contacteurs et des démarreurs conçus pour les puissances nominales en horse-power (hp).
- 1.5. Protection du moteur
 - 1.5.1. Moteurs monophasés — Ces moteurs sont parfois munis d'une protection thermique intégrée (consulter la plaque signalétique). Dans le cas contraire, utiliser un contacteur à protection appropriée contre les surcharges. Les dispositifs fusibles sont permis.
 - 1.5.2. Moteurs triphasés — Employer une protection trois conducteurs appropriée contre les surcharges thermiques ainsi qu'un démarreur magnétique convenant à la charge électrique.

1.6. Limites d'utilisation maximales :

Température du liquide : 100 °C (212 °F), avec joint standard ;
120 °C (250 °F), avec joint pour hautes températures en option.
Pression : 517 kPa (75 lb/po²).
Démarrages par heure : 20, répartis uniformément.

1.7. Une inspection et un entretien réguliers augmenteront la durée de vie de l'appareil. Établir un programme d'entretien et d'inspection basé sur le temps de fonctionnement. Voir la section 8.



2. Installation

2.1. Généralités

- 2.1.1. Placer la pompe aussi près de la source de liquide que possible, mais plus bas pour assurer l'amorçage automatique.
- 2.1.2. Protéger l'appareil contre les inondations et le gel.
- 2.1.3. Laisser assez d'espace pour l'entretien et l'aération.
- 2.1.4. La tuyauterie doit posséder ses propres supports et « s'aligner » correctement sur la pompe.

ATTENTION

Poser la tuyauterie de façon à n'appliquer aucune contrainte sur les raccords d'aspiration et de refoulement de la pompe.

- 2.1.5. Ne poser aucun accessoire ni raccord de tuyauterie superflu. Choisir le calibre qui réduit les pertes de charge par frottement au minimum.

2.2. Pompes montées sur moteur :

- 2.2.1. Les pompes peuvent être installées sur une surface horizontale, inclinée ou verticale.

ATTENTION

Ne pas placer le moteur plus bas que la pompe afin de le protéger contre les fuites et l'eau de condensation.

- 2.2.2. L'assise doit être plane et solide pour empêcher que le serrage des boulons ne cause de contraintes. Monter l'appareil sur caoutchouc pour réduire le bruit et les vibrations au minimum.
- 2.2.3. Serrer les boulons de fixation du moteur avant de raccorder la tuyauterie à la pompe.

2.3. Pompes montées sur palier :

- 2.3.1. Il est recommandé de remplir de coulis le vide entre la plaque de base et la dalle reposant sur une semelle de fondations solide (v. fig. 1).

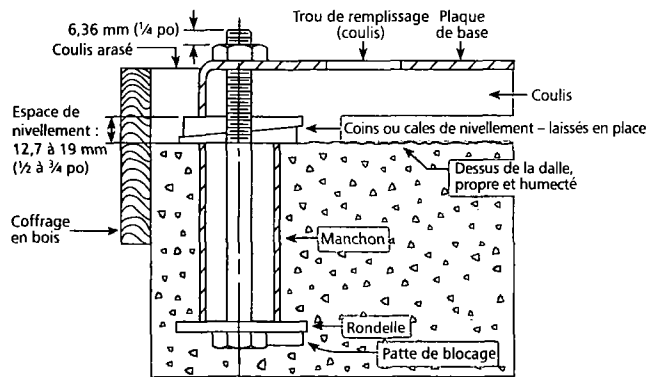


Figure 1

2.3.2. Placer l'appareil sur des coins de nivellement situés en quatre points distincts : deux sous le centre approximatif du moteur et deux sous celui de la pompe. Régler la position de l'appareil de manière à ce que la bride des raccords d'aspiration et de refoulement soit de niveau (avec un fil à plomb ou un niveau).

2.3.3. S'assurer que la plaque de base n'est pas déformée et que l'alignement final de l'accouplement est possible dans les limites de déplacement ou de calage du moteur.

2.3.4. Serrer les boulons d'ancrage à la main et construire un coffrage autour de la plaque de base. Verser du coulis sous la plaque et s'assurer qu'il n'y a aucun creux sous la plaque-support de la pompe et du moteur. Laisser le coulis durcir pendant 48 heures avant de serrer les boulons d'ancrage à fond.

2.3.5. Serrer les boulons de fixation de la pompe et du moteur avant de raccorder les tuyaux à la pompe.

3. Tuyauterie d'aspiration

3.1. Une hauteur géométrique d'aspiration réduite et une tuyauterie directe et courte sont souhaitables. Si la hauteur d'aspiration dépasse 3 m (10 pi), et la température du liquide, 49 °C (120 °F), consulter la courbe de débit de la pompe pour obtenir la hauteur nette d'aspiration requise (NPSHR).

3.2. Le calibre du tuyau d'aspiration doit être au moins égal à celui du raccord d'aspiration de la pompe pour éviter une perte de performances.

3.3. S'il faut un tuyau plus gros, on doit installer près de la pompe un raccord excentré (le côté non oblique en haut).

3.4. Pompe placée plus bas que la source de liquide :

3.4.1. Poser un robinet d'isolement à passage intégral sur le tuyau d'aspiration pour l'inspection et l'entretien.

ATTENTION

Ne pas employer le robinet d'isolement pour réduire la section de passage vers la pompe.

3.5. Pompe placée plus haut que la source de liquide :

3.5.1. Afin de prévenir les poches d'air, aucun élément de la tuyauterie d'aspiration ne devrait être plus haut que le raccord d'aspiration de la pompe. Incliner la tuyauterie vers le haut à partir de la source de liquide.

3.5.2. Chaque joint doit être étanche.

3.5.3. N'employer un clapet de pied que s'il est nécessaire pour amorcer la pompe ou la maintenir amorcée durant les arrêts.

3.5.4. La section de passage de la crépine du tuyau d'aspiration doit être au moins le triple de celle du tuyau.

3.6. Le diamètre (d) et la hauteur d'immersion minimale (h min.) de l'entrée du tuyau d'aspiration doivent être suffisants pour empêcher l'aspiration d'air par vortex (v. fig. 2 à 5).

3.7. Enrouler les filets des raccords de 3 ou 4 couches de ruban de téflon pour les étancher.

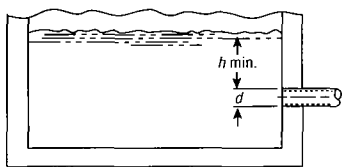


Figure 2

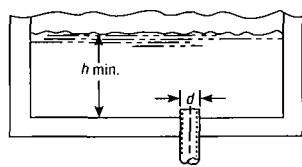


Figure 3

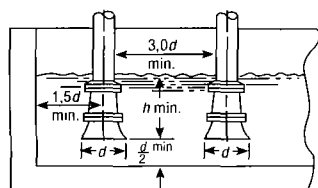


Figure 4

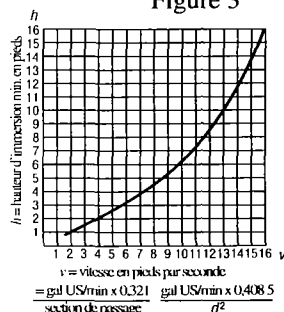


Figure 5

4. Tuyauterie de refoulement

4.1. L'installation doit comporter un robinet-vanne, ainsi qu'un clapet de non-retour placé entre le robinet-vanne et la pompe. Le robinet-vanne sert à la régularisation du débit et à l'inspection de la pompe et du clapet de non-retour.

4.2. Si un raccord agrandisseur est nécessaire, le poser entre le clapet de non-retour et la pompe.

4.3. Enrouler les filets des raccords de 3 ou 4 couches de ruban de téflon pour les étancher.

5. Alignement des arbres — moteur et pompe

5.1. Pompes montées sur moteur :

5.1.1. Aucun alignement sur place n'est requis.

5.2. Pompes montées sur palier :

5.2.1. Les arbres ont été alignés en usine, mais le transport peut parfois les désaligner. On doit donc vérifier l'alignement avant la mise en service de la pompe (v. fig. 6).

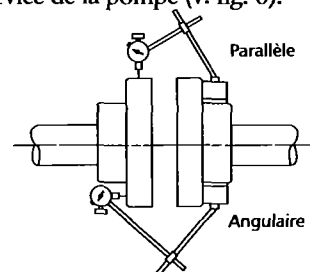


Figure 6

5.2.2. Serrer tous les boulons de fixation avant de vérifier l'alignement.

5.2.3. Si un alignement est nécessaire, on ne doit déplacer que le moteur. Employer des cales au besoin.

5.2.4. Désalignement parallèle (arbres parallèles mais non concentriques) — Fixer sur un moyeu un comparateur à cadran que l'on tourne de 360° le long de la périphérie de l'autre moyeu tout en notant l'amplitude de déplacement de l'aiguille. L'alignement est correct si le faux-rond total est de 0,127 mm (0,005 po) ou moins.

5.2.5. Désalignement angulaire (arbres concentriques mais non parallèles) — Fixer sur un moyeu un comparateur à cadran que l'on tourne de 360° le long du plateau de l'autre moyeu tout en notant l'amplitude de déplacement de l'aiguille. L'alignement est correct si le faux-rond total est de 0,127 mm (0,005 po) ou moins.

5.2.6. L'alignement final convient lorsqu'il satisfait aux exigences relatives à l'alignement parallèle et angulaire (après le serrage à fond des boulons de fixation du moteur).

ATTENTION

On doit toujours vérifier les deux types d'alignement après chaque réglage.

6. Rotation

6.1. La rotation appropriée s'effectue en sens horaire (vers la droite, vue de l'extrémité du moteur). Couper et rétablir le courant rapidement pour observer le sens de rotation de l'arbre. Changer le sens de rotation comme suit.

6.1.1. Moteur monophasé : irréversible.

6.1.2. Moteur triphasé : intervertir deux des conducteurs du moteur.

7. Utilisation

7.1. Avant la mise en service, on doit amorcer la pompe (pour en faire sortir l'air), remplir de liquide le tuyau d'aspiration et entrouvrir le robinet de refoulement.

ATTENTION

Les liquides pompés servent de lubrifiant. Si la pompe tournait à sec, les pièces mobiles gripperaient, et la garniture mécanique se détériorerait. Ne pas faire marcher la pompe quand le débit est nul ou presque, car le liquide absorberait la chaleur produite par frottement et pourrait se changer rapidement en vapeur. Les pièces mobiles doivent être lubrifiées par le liquide pour ne pas se détériorer ni gripper.

7.2. Faire fonctionner l'appareil dans des conditions de service normales jusqu'à ce que sa température se soit stabilisée, puis vérifier tout le système. Vérifier également si la tuyauterie se dilate. Dans le cas des pompes sur palier, la différence de température entre le moteur et la pompe peut causer le désalignement de l'accouplement. Vérifier l'alignement de nouveau.

8. Entretien

8.1. Dans le cas des pompes montées sur moteur, les roulements sont situés à l'intérieur du moteur et sont lubrifiés à vie. Aucun graissage n'est requis.

8.2. Pompes montées sur palier :

8.2.1. Les roulements de palier devraient être graissés toutes les 2 000 heures ou tous les trois mois, soit la période prenant fin la première. Employer une graisse au lithium ou au sodium n° 2. Remplir le roulement jusqu'à ce que la graisse sorte par les garnitures ou par les joints à lèvres, puis essuyer le surplus.

8.2.2. Suivre les directives de lubrification du fabricant du moteur et de l'accouplement.

8.2.3. Vérifier l'alignement de nouveau après tout travail d'entretien nécessitant le déplacement de l'appareil.

9. Démontage

Le démontage complet de la pompe est décrit ci-dessous. Ne démonter que ce qui permet d'effectuer l'entretien nécessaire.

9.1. Couper le courant.

9.2. Vidanger le système. Le rincer au besoin.

9.3. Dans le cas des pompes montées sur moteur, enlever les boulons de fixation de ce dernier. Quant aux pompes montées sur palier, enlever la bague et le carter d'accouplement ainsi que les boulons de fixation du palier.

9.4. Démontage de la tête de pompage :

9.4.1. Enlever les vis de fixation (370) du corps de pompe.

9.4.2. Écarter l'ensemble d'entraînement de la roue d'avec le corps de pompe (100).

9.4.3. Enlever l'écrou autofreiné (304) de la roue.

ATTENTION

Ne pas insérer de tournevis entre les aubes de la roue pour l'empêcher de tourner : enlever le couvercle d'extrémité du moteur et utiliser la fente ou les méplats de blocage de l'arbre ; on prévient ainsi l'endommagement de la roue.

9.4.4. Dévisser la roue (101) dans le sens antihoraire (vu du devant de la pompe). Se protéger les mains avec un linge ou des gants.

ATTENTION

Toute tentative de dévissage dans le sens horaire peut endommager les filets de la roue ou de l'arbre, ou des deux.

9.4.5. Retirer le logement de garniture (184) avec soin au moyen de deux leviers placés dans un angle de 180° entre le logement et l'adaptateur de moteur (108). L'élément mobile de la garniture mécanique (383) devrait sortir de l'arbre avec le logement.

9.4.6. Pousser l'élément fixe de la garniture mécanique hors du logement.

9.5. Démontage du palier :

9.5.1. Enlever le couvercle de palier (109).

9.5.2. Sortir l'arbre (122) du palier (228).

9.5.3. Si les joints à lèvres (138 et 139) sont usés et doivent être remplacés, les retirer du palier et du couvercle de palier.

9.5.5. À l'aide d'un arrache-roulement ou d'une presse à mandriner, extraire les roulements (112 et 168).

10. Remontage

10.1. Chaque pièce devrait être nettoyée avant le remontage.

10.2. Voir la liste de pièces pour déterminer celles qui sont requises. Préciser le numéro de pièce ou de catalogue de la pompe lorsque l'on commande des pièces.

10.3. Le remontage se fait dans l'ordre inverse du démontage.

10.3.1. Visser la roue et son écrou autofreiné sur l'arbre de moteur. Les serrer à 10 lbf·pi.

10.4. Observer les directives suivantes pendant le remontage du palier :

10.4.1. Remplacer les joints à lèvres s'ils sont usés ou endommagés.

10.4.2. Remplacer les roulements à billes s'ils ont du jeu, s'ils ne tournent pas rond ou s'ils sont bruyants.

10.4.3. Vérifier si l'arbre comporte des faux-ronds : le faux-rond maximal admissible est de 0,051 mm (0,002 po).

10.5. Observer les directives suivantes pendant le remontage de la tête de pompage :

10.5.1. Tous les éléments de la garniture mécanique doivent être en bon état pour empêcher les fuites. Le remplacement de la garniture en entier est une pratique courante appropriée chaque fois que la garniture est enlevée. On peut utiliser de la glycérine ou un autre lubrifiant léger pour faciliter la pose de la garniture, dont on ne doit pas contaminer la surface avec le lubrifiant.

10.5.2. Inspecter le joint torique (513) du corps de pompe et le remplacer s'il est endommagé. On peut employer du pétrolatum (vaseline) pour en faciliter la pose.

10.5.3. Inspecter le joint torique (349) du diffuseur et le remplacer s'il est endommagé.

ATTENTION

Ne pas lubrifier le joint torique (349) du diffuseur. S'assurer que le joint n'est pas pincé par la roue au cours du remontage.

10.6. Une fois la pompe remontée, vérifier s'il y a grippage. Apporter les corrections nécessaires.

10.7. Serrer les vis de fixation du corps de pompe en étoile pour prévenir le coincement du joint torique.

11. Diagnostic des anomalies

NON-FONCTIONNEMENT DU MOTEUR

(V. causes probables 1 à 6)

DÉBIT DE LIQUIDE FAIBLE OU NUL

(V. causes probables 7 à 17)

CONSOMMATION D'ÉNERGIE EXCESSIVE

(V. causes probables 4, 17, 18, 19 et 22)

VIBRATION ET BRUIT EXCESSIFS

(V. causes probables 4, 6, 9, 13, 15, 16, 18, 20, 21 et 22)

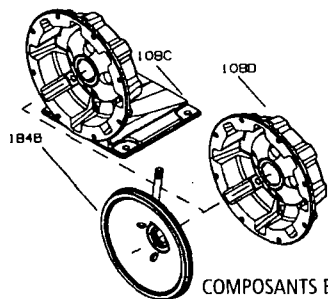
CAUSES PROBABLES :

1. Protecteur thermique déclenché
2. Disjoncteur ouvert
3. Fusible sauté
4. Pièces mobiles grippées
5. Moteur mal connecté
6. Moteur défectueux
7. Pompe non amorcée
8. Tuyau de refoulement obstrué ou robinet fermé
9. Mauvais sens de rotation
10. Clapet de pied trop petit, entrée de tuyau d'aspiration non immergée, crépine de tuyau d'aspiration obstruée.
11. Basse tension électrique
12. Perte de phase (moteurs triphasés seulement)
13. Présence d'air ou de gaz dans le liquide
14. Hauteur de charge trop élevée du système
15. Hauteur nette d'aspiration disponible (NPSHA) trop faible — hauteur ou perte d'aspiration excessives — à vérifier avec un vacuomètre
16. Roue usée ou engorgée
17. Diamètre de roue inapproprié
18. Hauteur de charge trop faible : débit excessif
19. Viscosité ou densité trop élevées
20. Roulements usés
21. Pompe ou tuyauterie mal assujetties
22. Pompe et moteur désalignés

Liste de pièces de rechange de la NPE standard

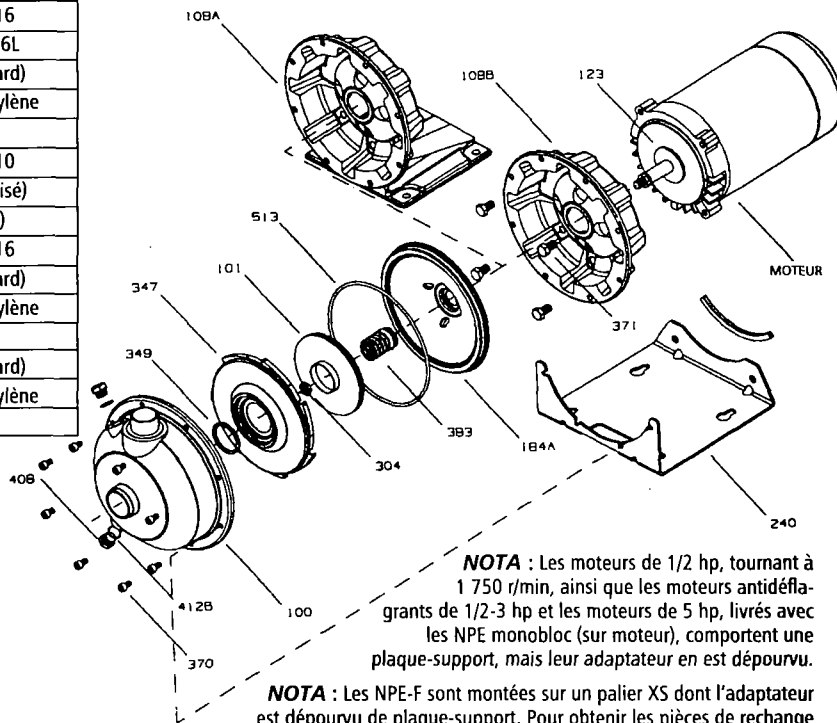
N° d'article	Description	Matériau
100	Corps de pompe	Inox AISI 316L
101	Roue	
108A	Adaptateur de moteur et plaque-support	
108B	Adaptateur de moteur sans plaque-support	
108C	Adaptateur de mot., plaque-supp. et rinceur	
108D	Adaptateur de moteur et rinceur sans plaque-supp.	Buna-N
123	Défecteur	
184A	Logement de garniture standard	Inox AISI 316L
184B	Logement de garniture et rinceur	
240	Plaque-support (moteur)	Inox 300
	Profilé en U	Caoutchouc
304	Écrou autofreiné (roue)	Inox AISI 316
347	Diffuseur	Inox AISI 316L
349	Joint d'étanchéité (diffuseur)	Viton (standard)
		Éthylène-propylène
		Buna
370	Vis à pans creux (corps de pompe)	Inox AISI 410
371	Vis (moteur)	Acier (galvanisé)
383	Garniture mécanique	(Voir table)
408	Bouchons — vidange et MAL (corps de pompe)	Inox AISI 316
		Viton (standard)
412B	Joints toriques (bouchons)	Éthylène-propylène
		Buna
		Viton (standard)
513	Joint torique (corps de pompe)	Éthylène-propylène
		Buna

MAL = mise à l'air libre



COMPOSANTS EN OPTION AVEC RINCEUR DE GARNITURE

Garnitures mécaniques (% po) — article n° 383				
Élément mobile	Élément fixe	Élastomère	Métal	N° de pièce
Carbone	Carbure de silicium	Éthyl.-propyl.	Inox 316	10K18
		Viton		10K55
Carbure de silicium		Éthyl.-propyl.		10K81
		Viton		10K62



NOTA : Les moteurs de 1/2 hp, tournant à 1 750 r/min, ainsi que les moteurs antidéflagrants de 1/2-3 hp et les moteurs de 5 hp, livrés avec les NPE monobloc (sur moteur), comportent une plaque-support, mais leur adaptateur en est dépourvu.

NOTA : Les NPE-F sont montées sur un palier XS dont l'adaptateur est dépourvu de plaque-support. Pour obtenir les pièces de rechange du palier XS, voir la page pertinente dans le catalogue des pièces. Le numéro d'article pour commander le palier complet est le 14L61.

GARANTIE LIMITÉE DE GOULDS PUMPS

La présente garantie s'applique à chaque pompe de système d'alimentation en eau fabriquée par Goulds Pumps.

Toute pièce se révélant défectueuse sera remplacée sans frais pour le détaillant durant la période de garantie suivante expirant la première : douze (12) mois à compter de la date d'installation ou dix-huit (18) mois à partir de la date de fabrication.

Le détaillant qui, aux termes de cette garantie, désire effectuer une demande de règlement doit s'adresser au distributeur Goulds Pumps agréé chez lequel la pompe a été achetée et fournir tous les détails à l'appui de sa demande. Le distributeur est autorisé à régler toute demande par le biais du service à la clientèle de Goulds Pumps.

La garantie ne couvre pas :

- les frais de main-d'œuvre ou de transport ni les frais connexes encourus par le détaillant ;
- les frais de réinstallation de l'équipement réparé ;
- les frais de réinstallation de l'équipement de remplacement ;
- les dommages indirects de quelque nature que ce soit ;
- ni les pertes découlant de la panne.

Aux fins de la présente garantie, les termes ci-dessous sont définis comme suit :

- « Distributeur » signifie une personne, une société de personnes, une société de capitaux, une association ou autre entité juridique servant d'intermédiaire entre Goulds Pumps et le détaillant pour les achats, les consignations ou les contrats de vente des pompes en question.
- « Détaillant » veut dire une personne, une société de personnes, une société de capitaux, une association ou autre entité juridique dont les activités commerciales sont la vente ou la location de pompes à des clients.
- « Client » signifie une entité qui achète ou loue les pompes en question chez un détaillant. Un « client » peut être une personne, une société de personnes, une société de capitaux, une société à responsabilité limitée, une association ou autre entité juridique se livrant à quelque activité que ce soit.

CETTE GARANTIE SE RAPPORTE AU DÉTAILLANT SEULEMENT.

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Visitez notre site (www.goulds.com).

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Imprimé aux É.-U.

Goulds Pumps



Please read and save this Replacement Parts Manual. Read this manual and the General Operating Instructions carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. The Safety Instructions are contained in the General Operating Instructions. Failure to comply with the safety instructions accompanying this product could result in personal injury and/or property damage! Retain instructions for future reference.

Teel® Electric Motor-Driven Pumps

Refer to Specifications Information and Replacement Parts Manual for product specific information

Safety Guidelines

This manual contains information that is very important to know and understand. This information is provided for SAFETY and to PREVENT EQUIPMENT PROBLEMS. To help recognize this information, observe the following symbols:

⚠ DANGER Danger indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

⚠ WARNING Warning indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

⚠ CAUTION Caution indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.

NOTE: indicates important information that, if not followed, may cause damage to equipment.

Unpacking

When unpacking the unit, inspect carefully for any damage that may have occurred during transit. Check for loose, missing or damaged parts. (See pump exploded view and Replacement Parts List.) Do not attempt to assemble or operate pump if any parts are missing or damaged. Determine that all parts are properly installed.

General Safety Information

1. Know the pump application, limitations, and potential hazards.

⚠ WARNING Pump should only be used with liquids compatible with pump component materials.

⚠ Do not use to pump flammable or explosive fluids such as

gasoline, fuel oil, kerosene, etc. Do not use in flammable and/or explosive atmospheres.

When pumping hazardous or dangerous materials, use only in room or area designated for that purpose. For your protection, always wear proper clothing, eye protection, etc. in case of any malfunction. For proper handling techniques and cautions, contact your chemical supplier, insurance company and local agencies (fire dept., etc.). Failure to comply with this warning could result in personal injury and/or property damage.

2. Make certain that the power source conforms to the requirements of your equipment.
3. Provide adequate protection and guarding around moving parts.
4. Disconnect power before servicing. If the power disconnect is out of sight, lock in the open position and tag it to prevent unexpected application of power. Failure to do so could result in fatal electric shock!
5. Release all pressure within the system before servicing any component.
6. Drain liquids from the system before servicing.
7. Secure the discharge line before starting the pump. An unsecured discharge line will whip, possibly causing personal injury and/or property damage.
8. Check hoses for weak or worn condition before each use. Make certain that all connections are secure.
9. Periodically inspect pump and system components. Perform routine maintenance as required (See Maintenance section).

10. Provide a means of pressure relief for pumps whose discharge line can be shut off or obstructed.

11. Personal Safety:

- a. Wear safety glasses at all times when working with pumps.
 - b. Wear a face shield and proper apparel when pumping hazardous chemicals.
 - c. Keep work area clean, uncluttered, and properly lighted; replace all unused tools and equipment.
 - d. Keep visitors at a safe distance from the work area.
 - e. Make workshop childproof - with padlocks, master switches, and by removing starter keys.
12. This unit is not waterproof and is not intended to be used in showers, saunas, or other potentially wet locations. The motor is designed to be used in a clean dry location with access to an adequate supply of cooling air. Ambient temperature around the motor should not exceed 104°F (40°C). For outdoor installations, motor must be protected by a cover that does not block airflow to and around the motor. This unit is not weatherproof nor is it able to be submersed in water.

13. When wiring an electrically driven pump, follow all electrical and safety codes, as well as the most recent United States National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA).

⚠ WARNING Risk of electric shock!

ENGLISH

ESPAÑOL

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Teel® Electric Motor-Driven Pumps

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General Safety Information (Continued)

14. THREE-PHASE MOTORS: These units are for permanent installation using a power supply with a ground. To reduce the risk of electric shock, electric motor must be adequately grounded to a metal raceway system, or by using a separate grounding wire connected to bare metal on the motor frame, or to the grounding screw located inside motor terminal box, or by other suitable means. Refer to the most recent National Electrical Code (NEC) Article 250 (Grounding) for additional information. **ALL WIRING SHOULD BE DONE BY A QUALIFIED ELECTRICIAN.**

⚠ WARNING *Risk of electric shock! Never connect the green (or green and yellow) wire to a live terminal!*

15. SINGLE PHASE MOTORS: These units can be wired for either portability, with flexible 3-wire cord, or permanent installation using a supply with a ground. To reduce the risk of electric shock, the motor must be securely and adequately grounded! This can be accomplished by either 1) inserting plug (portable) directly into a properly installed and grounded 3-prong grounding type receptacle (as shown in Figure A for 110-120 volt, or Figure B for 220-240 volt); 2) permanently wiring the unit with a grounded, metal raceway system; 3) Using a separate ground wire connected to the bare metal of the motor frame; 4) Other suitable means. The green (or green and yellow) conductor in the cord is the grounding wire.

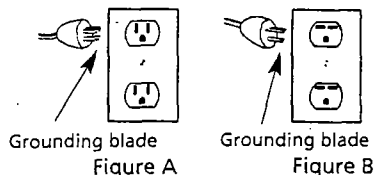


Figure 1 - Grounding Methods

Where a 2-prong wall receptacle is encountered, it must be replaced with a properly grounded 3-prong receptacle installed in accordance with the National Electrical Code, local codes and ordinances. To ensure a proper ground, the grounding means must be tested by a qualified electrician.

16. Use only 3-wire extension cords that have 3-prong grounding type plugs and 3-pole receptacles that accept the equipment plug.
17. All wiring should be performed by a qualified electrician.
18. Protect electrical cord from sharp objects, hot surfaces, oil, and chemicals. Avoid kinking the cord. Replace or repair damaged or worn cords immediately.
19. Keep fingers and foreign objects away from ventilation and other openings. Do not insert any objects into the motor.
20. Use wire of adequate size to minimize voltage drop at the motor.
21. Disconnect power before servicing a motor or its load. If the power disconnect is out of sight, lock it in the open position and tag it to prevent unexpected application of power.
22. Do not touch an operating motor. Modern motors are designed to operate at high temperatures.

⚠ WARNING *Do not handle a pump or pump motor with wet hands or when standing on a wet or damp surface, or in water.*



⚠ WARNING *All single phase pump motors are equipped with an automatic resetting thermal protector and may restart unexpectedly. Protector tripping is an indication of motor overloading as a result of operating the pump at low heads (low discharge restriction), excessively high or low voltage,*

inadequate wiring, incorrect motor connections, or a defective motor or pump.

Installation

⚠ WARNING *The pumps should not be used in flammable or explosive atmospheres. In order to safely use this product, familiarize yourself with this pump and also with the liquid (chemical, etc.) that is going to be pumped through the unit. This pump is not suitable for many liquids.*

For installations where property damage might result from an inoperative or leaking pump due to power outages, discharge line blockage, or any other reason, a backup system(s) should be used.

Failure to follow any warning can result in personal injury and/or property damage.

1. Locate pump as close to the fluid source as possible, thus making the suction line short and direct as possible.

⚠ CAUTION *The unit should be placed where the motor and electrical components are protected from the weather and extremes of heat, cold and humidity.*

2. Attach piping suction line to suction inlet and piping discharge line to discharge outlet. Avoid using looped section of pipe or fittings which might permit air to insure airtight pipe connections.

IMPORTANT: If plastic or fabric hose is used for the suction piping, it should be of a reinforced type so as not to collapse under suction. The suction piping should be one size larger than the discharge piping.

3. Support the piping independently of the pump to avoid universal or excessive stresses on the pump casing, which would cause impeller misalignment and possible pump failure.

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Teel® Centrifugal Laundry Tray Pump

Refer to form 554042 for General Operating and Safety Instructions and applicable Warranty.

Description

Teel centrifugal laundry tray pump is designed for gravity-feed pumping operations. Unit can handle laundry water or other nonflammable, non-abrasive fluids compatible with pump construction. Pump is equipped with mechanical seal (carbon face with Buna-N seal cartridge), cast aluminum body and impeller, and a Dayton split-phase motor. This is a manual unit, no controls are supplied.

Unit does not come supplied with any type of switch or control device to turn unit on or off.

For additional pump information, see Specifications and Performance.

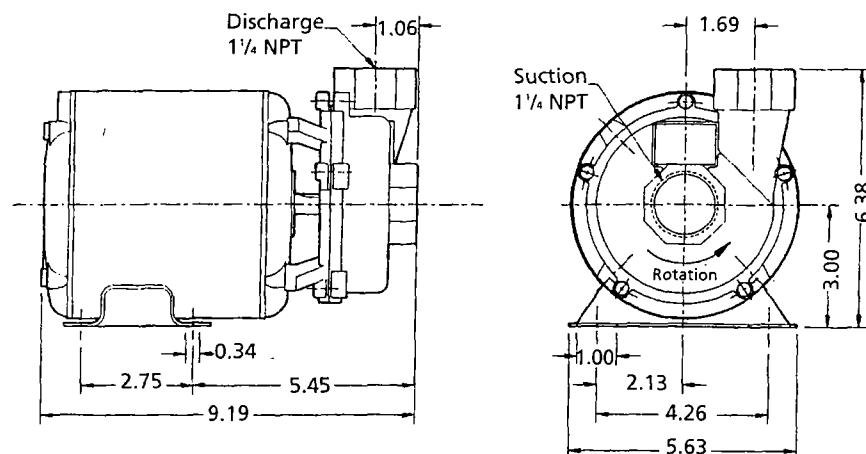


Figure 1 - Dimensions (±1/8")

Specifications

Suction Inlet	1 1/4" NPT
Discharge Outlet	1 1/4" NPT
Dimensions (overall)	6.38"H x 5.63"W x 9.19"L
Motor	1/4 HP
Power Supply	115V, 60 Hz
RPM	1725
Weight	18 Lbs.
Max Liquid Temp	120°F

Performance

GPH of Water at Total Head in Feet						
2'	4'	6'	8'	10'	11'	
1400	1200	1000	700	250	SHUTOFF	

1. Locate pump as close to the laundry tub as possible. Support the pump and piping adequately to keep pump and piping from being strained.
2. Pitch the piping from tub drain to pump suction to avoid air traps. (Do not use the conventional trap). Keep the pipe-size at least 1 1/4". Use pipe dope to avoid joint leakage. Install necessary piping for pressure switches or any other control devices (not supplied). Follow manufacturer's instructions for their installation.
3. Install a check valve on the discharge side to prevent drain-back.
4. Locate check valve below level of bottom of tub.
5. Wire motor by following wiring diagram on nameplate. It is strongly recommended that this unit is plugged into a GFCI (Ground Fault Circuit Interrupter). Consult your local electrician for installation and availability. Be sure unit is grounded (General Safety Information). If unit is to be controlled by an on and off switch, install at this time.

Installation

Refer to Figure 2 and proceed as follows:

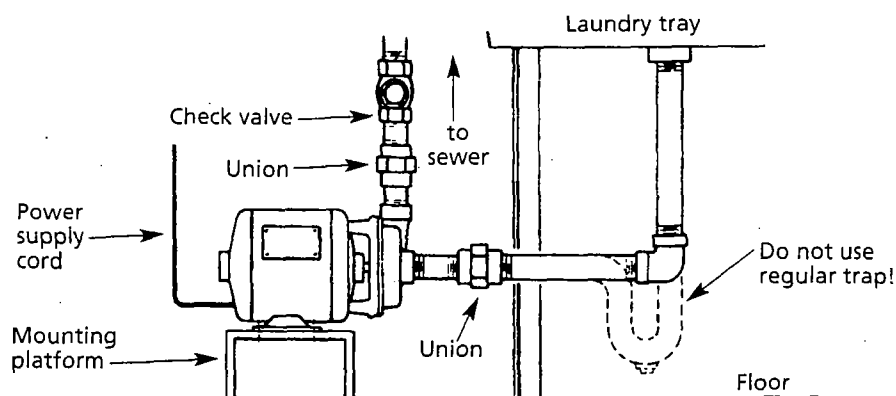


Figure 2 - Typical Installation

Teel® Centrifugal Laundry Tray Pump

E
N
G
L
I
S
H

Installation (Continued)

6. If laundry water from a washer is discharged into the laundry tub, it should be filtered. Filtering can be accomplished many ways. An easy way is by taking an old pair of panty hose, putting one leg into the other, and then putting it on the end of the washer discharge hose with a rubber band. Most of the panty hose should be lying in the laundry tub. Eventually, the panty hose will become full of lint and a hole will develop. The panty hose should then be replaced.

7. Installation is now complete.

NOTE: To prevent accidents, locate motor in a suitable (ventilated) enclosure, or guard all moving parts and ventilation openings.

Operation

Turn unit on by either plugging pump in, turning switch on, or if unit is installed with an automatic device, (not supplied) it will activate itself as well as turn itself off. On units without automatic devices, it is necessary to shut pump off when water stops draining out of the tub (last couple of inches). The pump has become airborne. After a few seconds, when the water has gone down, turn unit on again. The unit may have to be turned on and off a few times to completely drain tub. This is normal. When water has been completely pumped out of the tub, turn pump off immediately.

Maintenance

⚠ WARNING *Disconnect from power source before servicing or inspecting the pump for any reason. Failure to do so could result in fatal electrical shock!*

MOTOR

Dirt accumulations can cause motor overheating and a fire hazard. Remove dirt accumulations from the motor, especially in and around vent openings by vacuuming.

Periodically inspect the installation.

Check for dirt accumulations; unusual noises or vibration; overheating; worn or loose couplings, sheaves and belts; high motor current; poor wiring or overheating connections; loose mounting bolts or guards.

The motor used with this pump uses sleeve bearings which require periodic re-oiling. Each motor has two bearings, which should be lubricated once a year. The bearings are located around the motor shaft (See Figure 3), at each end of the motor. The oil reservoirs have plastic plugs covering them. Pull out the plugs and put oil in. Replace plugs after oiling.

Follow re-oiling instructions on the motor (see nameplate or terminal box cover). If instructions are not included, re-oil once a year with 30-35 drops of SAE No. 20 non-detergent or electric motor oil. Do not over-lubricate.

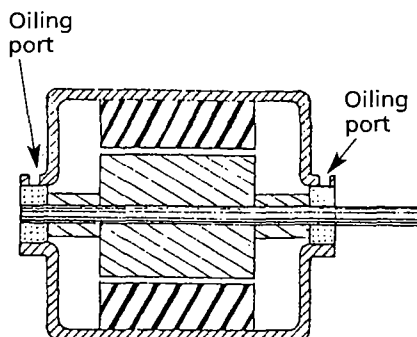


Figure 3 – Location of Sleeve Bearings for Lubrication

PUMP

There is no normal pump maintenance. Some work might be required on the pump when output has been reduced or when seal leaks. This can be caused by lint build-up around the impeller. Disassemble pump (See Mechanical Seal Replacement), remove impeller (Ref. No. 5) and clean out, then re-assemble.

MECHANICAL SEAL REPLACEMENT

After the pump has been in service for a long period of time, or if the pump has been in severe service, it may be necessary to replace the seal. Leakage can be detected by a dripping or flow of liquid from the area around the motor shaft.

⚠ CAUTION *The precision lapped faces on the mechanical seal are easily damaged. Handle your replacement seal carefully and read these instructions before attempting to replace the seal.*

Refer to Figure 6 for Parts Illustration.

1. Disassemble the volute casing (Ref. No. 8) and gasket (Ref. No. 7) from the adapter (Ref. No. 2) by removing the five screws (Ref. No. 9).
2. Notice the location of the impeller (Ref. No. 5) on shaft. It should be compressing the seal cartridge (Ref. No. 3). Loosen setscrew (Ref. No. 6) and the impeller will slide off the shaft.
3. Pry the ceramic portion of the seal seat (Ref. No. 4) from the impeller recess with a small screwdriver. Now remove the rubber portion of the seal seat from the same recess (See Figure 4).

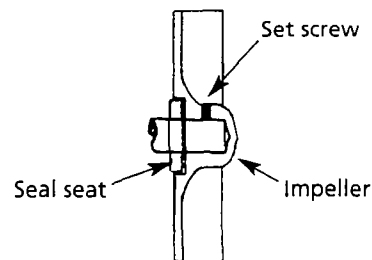


Figure 4 – Mechanical Seal

4. Force the old seal cartridge out of the adapter by pushing from the motor side.

NOTE: Use a 1/4" pipe or a socket from a tool set.

For Replacement Parts, call 1-800-323-0620

24 hours a day – 365 days a year

Please provide following information:

- Model number
- Serial number (if any)
- Part description and number as shown in parts list

Address parts correspondence to:

Grainger Parts
P.O. Box 3074
1657 Shermer Road
Northbrook, IL 60065-3074 U.S.A.

ENGLISH

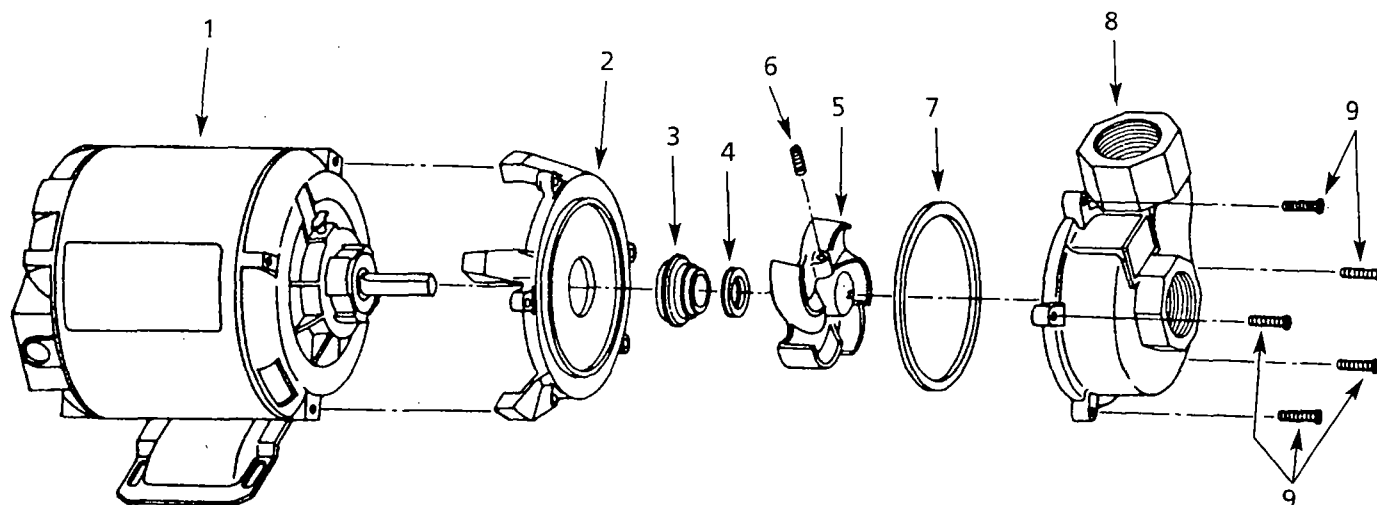


Figure 6 – Replacement Parts Illustration

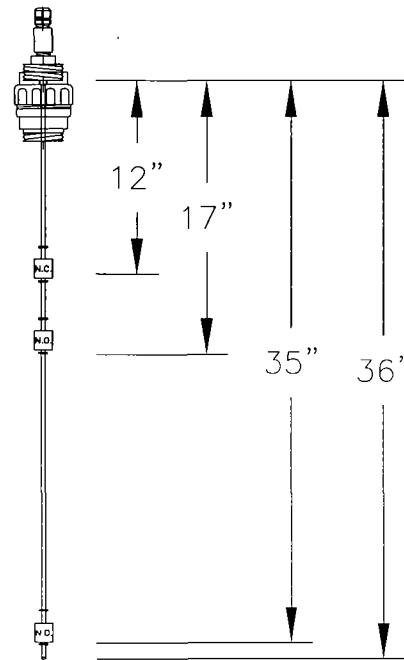
Replacement Parts List

Reference Number	Description	Part Number	Quantity
1	Motor	† 5K279C	1
2	Adapter	1586-001-01	1
3	▲ Seal cartridge	1R302	1
4	▲ Seal seat		
5	Impeller	1585-000-01	1
6	1/4-28 x 1/2" Allen hd. setscrew	*	1
7	Gasket (square ring)	1531-000-00	1
8	Casing (volute)	1584-000-01	1
9	#10-32 x 7/8" Slotted hex machine screw	*	5

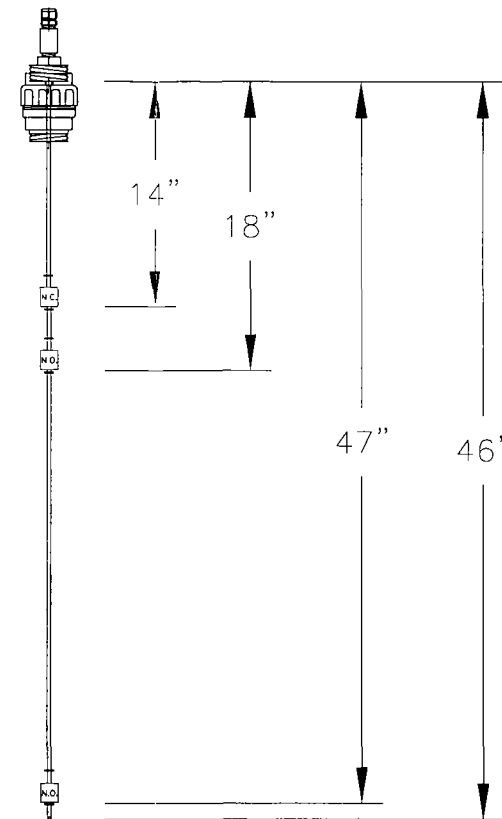
(▲) Available as a set only.

(*) Standard hardware item, available locally.

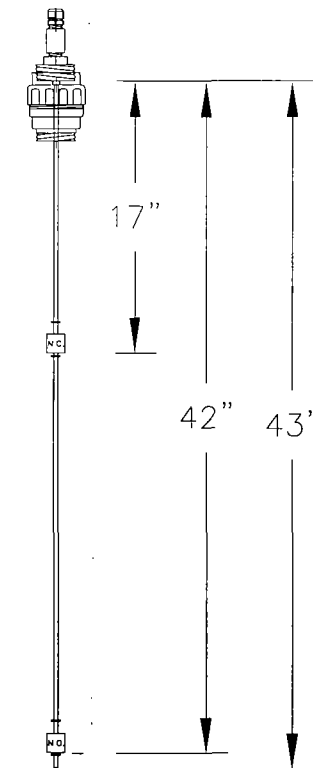
(†) Replacement motor may look slightly different, but is a more economical substitute.



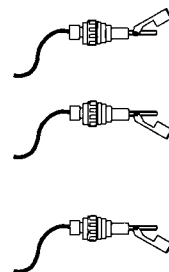
OWS OIL SUMP



OWS WATER SUMP



5000 GALLON PRODUCT TANK



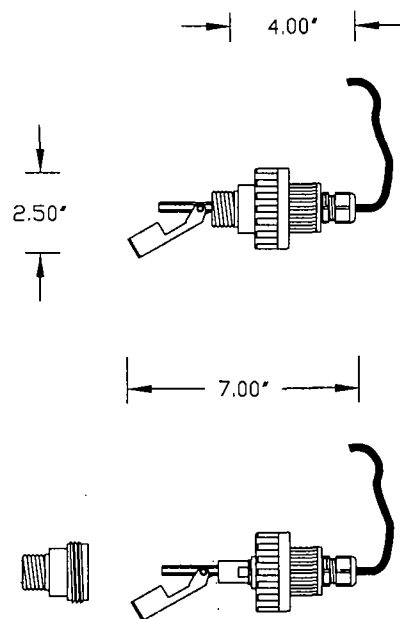
2500 GALLON SURGE TANK



MAIN OFFICES and PRODUCTION
11929 PORTLAND AVENUE SOUTH
BURNSVILLE, MN. 55337
Tel: 952-707-9101
Fax: 952-707-1075

TOLERANCES $\pm .250"$
DRAW. NUMB. 02-072 SENSORS

CLIENT	ENVIRONMENTAL QUALITY MANAGEMENT			DATE	10/10/02		
SITE	GARY AIRPORT			BY	SCOTT PETERSON SYSTEMS ENGINEER		
TITLE-1	SYSTEM SENSOR SPECIFICATIONS			PAGE	01	OF	01
TITLE-2				SCALE	AS SHOWN		
REVISION	01	BY	0	DATE	0		
REVISION	02	BY	0	DATE	0		
REVISION	03	BY	0	DATE	0		



FEATURES

SCH 80 PVC BODY
 POLYPROPYLENE FLOAT SWITCH (.55 Sp. Gr.)
 18/2 SJOW SIGNAL LEAD
 FITS SMALL 3/4" NPT
 FIELD SERVICABLE

OPTIONS

CPVC BODY (HIGHER TEMP.)
 NYLON FLOAT (.65 Sp. Gr. FOR FUELS)
 VERSAPLAST FLOAT (.80 Sp. Gr. HIGHER TEMP.)
 ALL STAINLESS CONSTRUCTION (.80 Sp. Gr.)

ELECTRICAL RATING

MAX. RESISTIVE LOAD
 20 VA - UL RECOGNIZED
 VOLTS AMPS AC. AMPS DC.

0-30	.4	.3
120	.17	.13
240	.08	.06

PRODUCT LEVEL CONTROL SIDE MOUNT LEVEL SWITCH

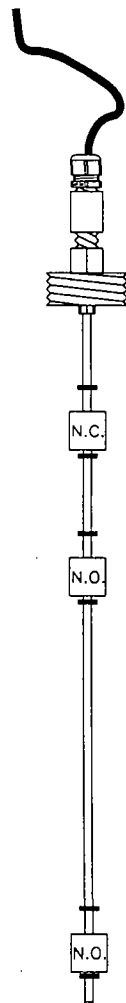
SWITCH FUNCTION
(WIRE COLOR)

HIGH LEVEL ALARM
(RED)

PUMP ON
(WHITE)

PUMP OFF
(BLACK)

GROUND
(GREEN)



FEATURES

BRASS MAIN BODY
STAINLESS STEEL SHAFT
STAINLESS STEEL FLOATS (.65 Sp. Gr.)
18/4 SJOW SIGNAL LEAD (VARIES w/ POINTS)
FITS 2" NPT TANK OPENING
LENGTHS to 72"
UP TO 5 N.O or N.C. LEVEL POINTS
SERVICABLE

OPTIONS

STAINLESS BODY
POLYPROPYLENE FLOAT (.65 Sp. Gr.)
SCH 80 PVC BODY & SHAFT
SCH 80 CPVC BODY & SHAFT

ELECTRICAL RATING

MAX. RESISTIVE LOAD — UL RECOGNIZED

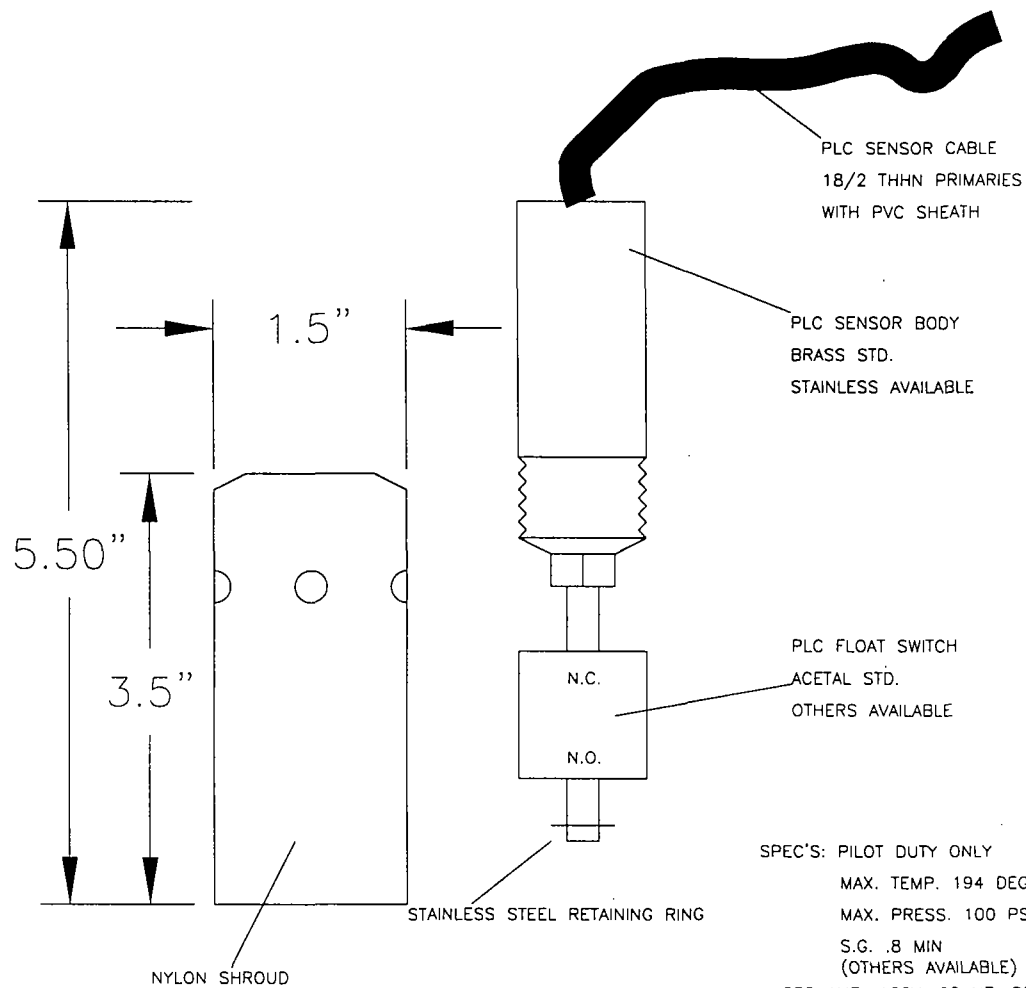
REED SWITCH DATA

MAX. DC VOLTS 250	AC OPERATION @ 120 VAC 60 Hz
MAX. DC AMPS SWITCHING 3.0	MAX. AC AMPS SWITCHING or RUNNING 3.0
MAX. DC AMPS RUNNING 6.0	WITH NO TRANSIENT VOLTAGES

PRODUCT LEVEL CONTROL MULTI-LEVEL TANK SENSOR

CAUTION: Your PLC control float is a delicate instrument, and should be treated as such. A dropped or roughly handled float body may result in damaging the internal reed switch, rendering the unit inactive.

- CLEANING: 1. Remove the nylon shroud by unscrewing it from the float body. Slide the shroud over the float and stem.
2. Remove the retaining ring and slide the float off of the stem.
3. Gently clean the float and stem with a soft cloth or rag. The parts may be scraped gently if there is severe contamination on the float or stem.
4. Reassemble the unit, paying attention to the direction of the float actuation —n.o. or n.c.— then re-attach the shroud.
5. The unit should then be tested before placing back into service.



SPEC'S: PILOT DUTY ONLY
 MAX. TEMP. 194 DEG. F.
 MAX. PRESS. 100 PSI
 S.G. .8 MIN
 (OTHERS AVAILABLE)
 .080 AMP, 120V, 60 HZ, RESISTIVE
 .040 AMP, 240V, 60 HZ, RESISTIVE
 3.36 VA, 240V, 60 HZ

GENERAL OFFICES
 11929 PORTLAND AV. S.
 BURNSVILLE, MN. 55337
 Tel: 612-707-9101
 Fax: 612-707-1075

TOLERANCES
 UNLESS
 OTHERWISE
 SPECIFIED
 ± .050"



Customer	REFERENCE	Drawing No.	CONTROL-FLOAT-SPECS	Rev	0
Site Reference		Sheet No.	Sht 1 of 1	Scale	NONE
		Drawn By	SDP	Drawn Date	1/15/90
Cust. No.	PLC Sales No.	Title	PLC CONTROL FLOAT W/ LEAD		

Product Level Control

Multi-Level Switch

2" Pipe Threaded Mount

Brass Body

304SS Shaft

Buna N Floats

25' Length of 18/4, SJOW Cable

Float intervals defined by customer

Maximum contact rating: 15W

Maximum switching voltage: 250 VDC

Maximum switching current: 3A

Typical life: 10⁶

Single pole, single throw switch (SPST)

18 gauge stranded copper conductor

Typically uppermost float is Normally Closed (NC), while lower floats are Normally Open (NO). Other combinations of NO and NC are available. Please notify at time of order.

Wire Coding: Green (Common), Red (HHL, NC), White (HL, NO), Black (LL, NO)

Maximum Pressure: 50 PSI

Minimum Specific Gravity: 0.81

Length: Up to 72"

Diameter: 1.78"

- Used in conjunction with a control panel, three floats set at different intervals on a single rod operate together to control a transfer pump. When liquid levels reach the high float, the pump activates until liquid is pumped below the low float. The uppermost float acts as a tank full sensor to prevent overflow.

Float 1 Inches
Float 2 Inches
Float 3 Inches

Design allows up to 5 level points on a single assembly.

Various materials of construction allow for chemical resistance.

SS guide included to prevent floats from contacting the wall of the tank or the wall of the sight tube.

Cord Type 0-NEMA 4 JBox S-SJOW	Mounting Thread E-2" MNPT F-3" MNPT G-4" MNPT
Cord Length 0-NA 1-25' 2-50' 3-75' 4-100' <small>Custom lengths available</small>	Rod Material 1-304SS 2-316SS 3-Brass
Float Material 1-316SS 2-Buna N	Number of Floats 1-1 2-2 3-3 4-4 5-5
Body Material 1-PVC 2-CPVC 3-Brass	Float Location in Inches <small>Measurement needed for each float</small>

SDXX-ML 1 2 -XX 1/2 3

Product Level Control

Multi-Level Switch

PRODUCT
TANK

2" Pipe Threaded Mount

Brass Body

304SS Shaft

Buna N Floats

25' Length of 18/4, SJOW Cable

Float Intervals defined by customer

2-LEVEL
FLOAT
1" DO 6840"

Maximum contact rating: 15W
 Maximum switching voltage: 250 VDC
 Maximum switching current: 3A
 Typical life: 10⁶

Single pole, single throw switch (SPST)

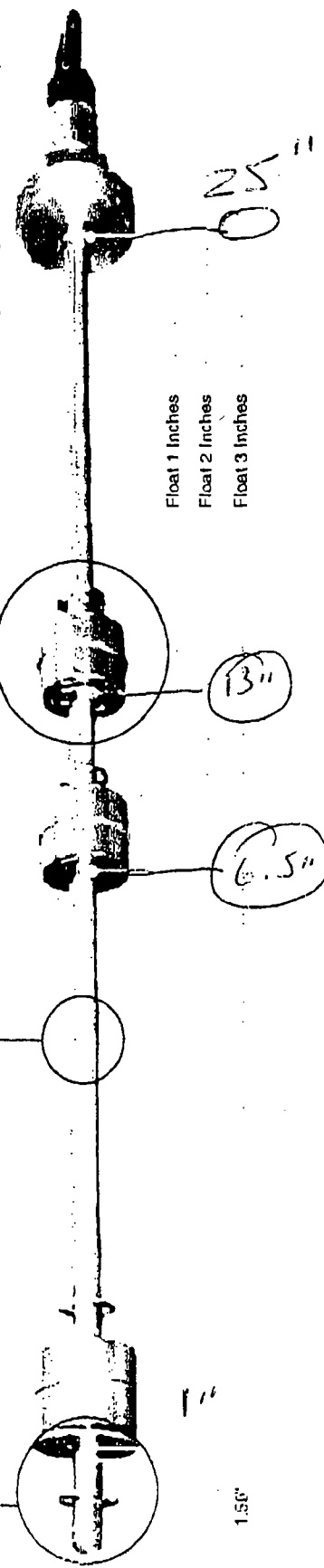
18 gauge stranded copper conductor

Typically uppermost float is Normally Closed (NC), while lower floats are Normally Open (NO). Other combinations of NO and NC are available. Please notify at time of order.

Wire Coding: Green (Common), Red (HHL, NC), White (HL, NO), Black (LL, NO)

Maximum Pressure: 50 PSI
 Minimum Specific Gravity: 0.61
 Length: Up to 72"
 Diameter: 1.78"

- Used in conjunction with a control panel, three floats set at different intervals on a single rod operate together to control a transfer pump. When liquid levels reach the high float, the pump activates until liquid is pumped below the low float. The uppermost float acts as a tank full sensor to prevent overflow.



Design allows up to 5 level points on a single assembly.

Various materials of construction allow for chemical resistance.

SS guide included to prevent floats from contacting the wall of the tank or the wall of the sight tube.

Cord Type 0-NEMA 4 JRoX 5-SJOW	Mounting Thread E-2" MNPT F-3" MNPT G-4" MNPT
Cord Length 0-NA 1-25' 2-50' 3-75' 4-100' <i>custom lengths available</i>	Rod Material 1-304SS 2-316SS 3-Bronze
Float Material 1-316SS 2-Buna N	Number of Floats 1-1 2-2 3-3 4-4 5-5
Body Material 1-PVC 2-CPVC 3-Bronze	Float Location in Inches <i>Measurement marked on sight tube</i>

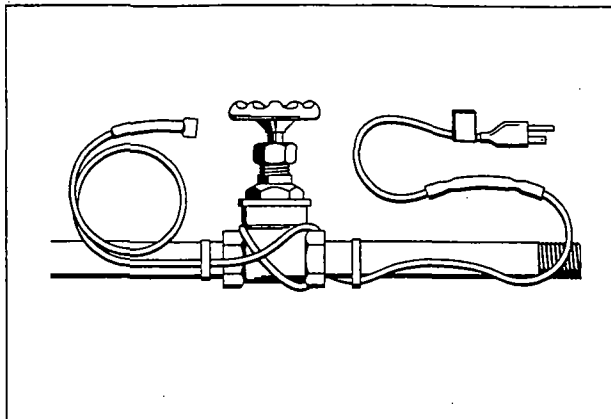
SDXX-ML -XX

156"

PRODUCT LINE
HEAT TREATING

Raychem

* HEAT TRACING SPEC'S FOR
OUTSIDE PRODUCT LINE
LEADING TO 5000 GALLON OIL
TANK



Gardian W51

Preassembled electric heating cables

Installation Instructions

Description

Gardian W51 120-Vac preassembled electric heating cables are intended for installation on metal or plastic water pipes for freeze protection in residential and commercial locations. Gardian W51 heating cables are available in 6-, 12-, 18-, 24-, 50-, 75-, and 100-foot lengths, and each comes complete with a 30-inch power cord and plug.

Kit contents

1 Gardian W51 preassembled electric heating cable

Additional items needed but not supplied

Thermal insulation, waterproof covering for the insulation, a 120-V ground-fault-protected receptacle, and cable ties or glass cloth tape.

Approvals



60J9 Residential and Mobile Home Pipe Heating Cables and 718K Pipe Heating Cables

LISTED



DESIG. 2E, 3A, 3B, 3C, 3D

Heating cable selection

Determine which Gardian W51 heating cable you will need:

Use the tables to the right to select the correct heating cable. Round up to the next pipe size if your pipe diameter isn't shown. Add 1 foot to your pipe length for each valve or spigot on your pipe system.

The charts assume the lowest outside temperature is 0°F (-18°C), with a minimum of 1/2" fiberglass insulation or equivalent. For protection to -20°F (-29°C), use 1" fiberglass insulation or equivalent fire-resistant insulation.

If length of cable selected is longer than the pipe, spiral cable evenly along the entire pipe.

Important

All thermal and design information provided here is based upon a "standard installation": heating cable fastened to a pipe and thermally insulated. For any other method of installation or application, consult Raychem at (800) 542-8936

Product selection charts

A W51-6P B W51-12P C W51-18P D W51-24P E W51-50P F W51-75P G W51-100P

METAL PIPES (0°F / -18°C metal pipe freeze protection with 0.5" insulation or -20°F / -29°C with 1" insulation)

PIPE DIAMETER	3'	6'	9'	12'	15'	18'	21'	24'	27'	30'	40'	50'	60'	70'	80'	90'	100'
0.5"	A	A	B	B	C	C	D	D	E	E	E	F	F	G	G	G	G
1"	A	A	B	B	C	C	D	D	E	E	E	F	F	G	G	G	G
1.5"	A	A	B	B	C	C	D	D	E	E	E	F	F	G	G	G	G
2"	A	A	B	B	C	C	D	D	E	E	E	F	F	G	G	G	G
2.5"	A	B	B	C	C	D	E	E	E	E	F	F	G	G	G	G	=

PLASTIC PIPES (0°F / -18°C plastic pipe freeze protection with 0.5" insulation, or -20°F / -29°C with 1" insulation)

PIPE DIAMETER	3'	6'	9'	12'	15'	18'	21'	24'	27'	30'	40'	50'	60'	70'	80'	90'	100'
0.5"	A	A	B	B	C	C	D	D	E	E	E	F	F	G	G	G	G
1"	A	B	B	C	C	D	D	E	E	E	F	F	G	G	G	G	=
1.5"	A	B	C	C	D	D	E	E	E	F	F	G	=	=	=	=	=
2"	A	B	C	D	E	E	E	E	F	F	G	=	=	=	=	=	=
2.5"	B	C	D	D	E	E	E	F	F	F	F	=	=	=	=	=	=

for design assistance to ensure proper design of electrical distribution and acceptable pipe temperatures.

Note: = indicates that no Gardian cable is recommended; contact Raychem for further information.

WARNING:

Fire and shock hazard. This product is an electrical device that must be installed correctly to ensure proper operation and to prevent shock or fire. Read these important warnings and carefully follow all the installation instructions.

- To minimize the danger of fire from sustained electrical arcing if the heating cable is damaged

or improperly installed, and to comply with the requirements of Raychem, agency certifications, and the National Electrical Code, ground-fault equipment protection must be used on each heating cable branch circuit. Arcing may not be stopped by conventional circuit protection.

- Use only fire-resistant insulation materials such as fiberglass wrap.

- Do not damage the heating cable and cord connector. Remove any damaged cables from service immediately.
- Do not use any wire or metal clamps to attach the cable to the pipe. Use tape (1/2 inch wide to 1 inch wide) or plastic cable ties.
- Leave these installation instructions with the user for future reference.

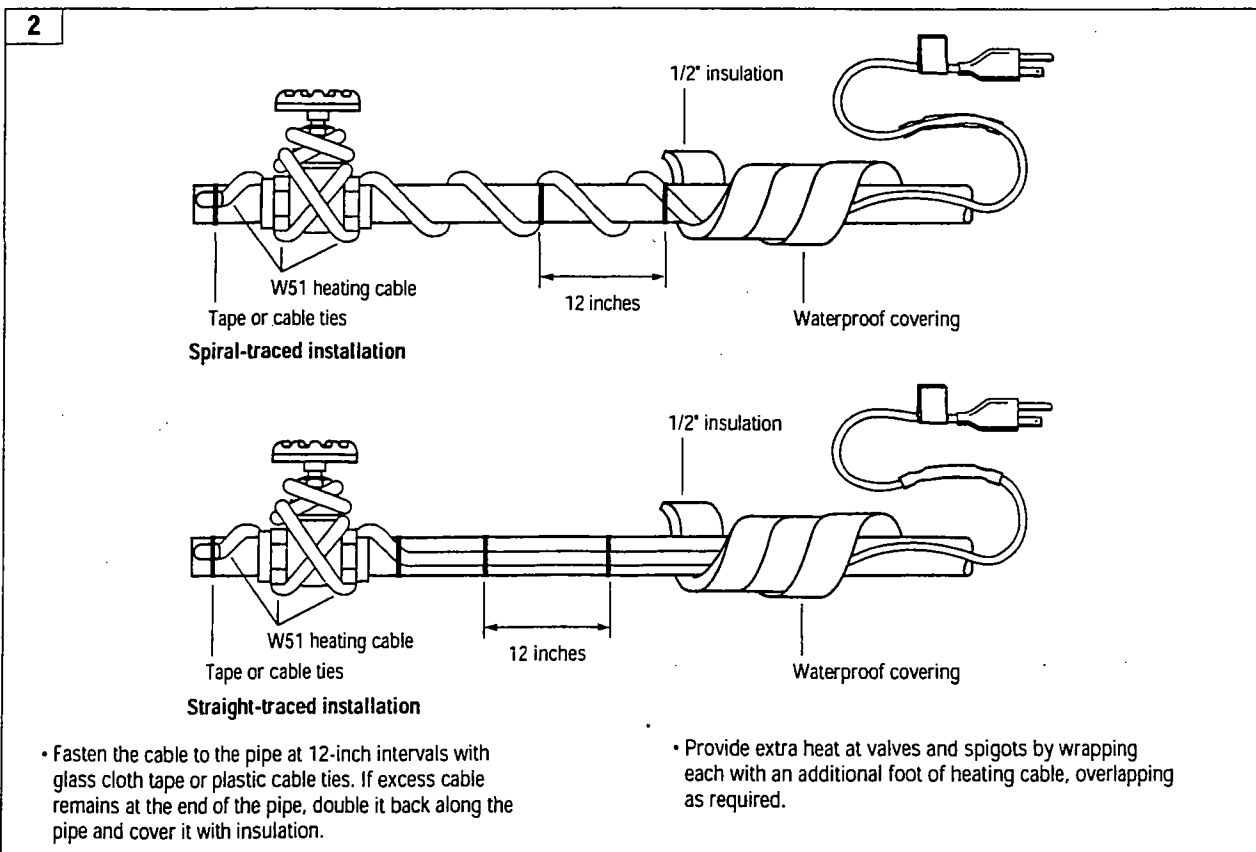
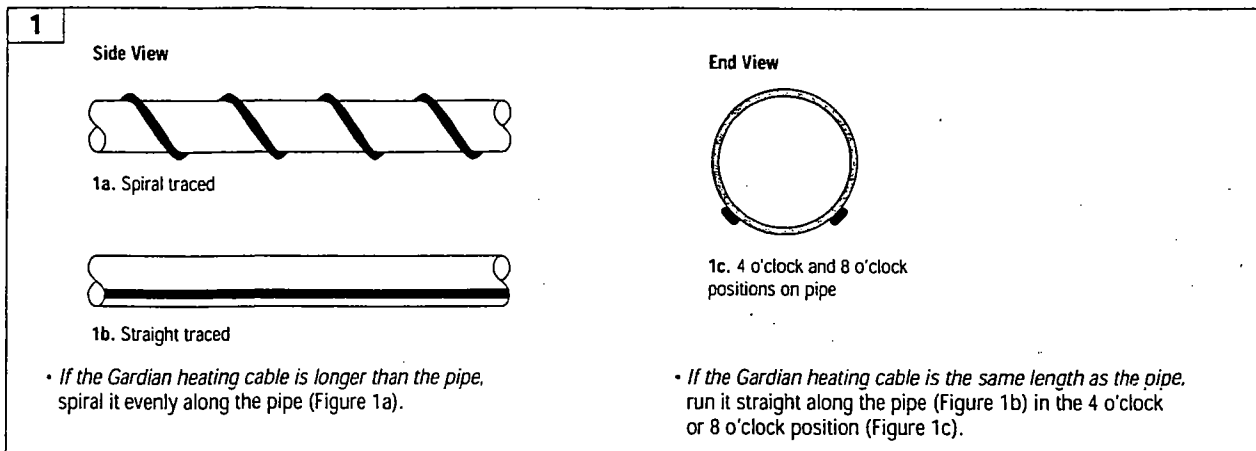
W51 Heating Cable Installation Instructions

General requirements:

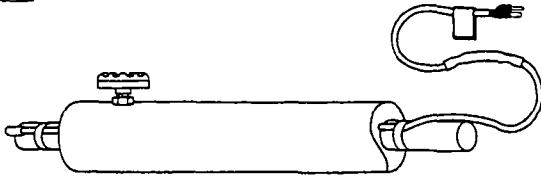
- Gardian heating cables are not intended for use *inside* any pipes, for freeze protection of liquids other than water, or for use in classified hazardous locations.
- Gardian heating cables may be used on metal and plastic water pipes but not on flexible vinyl tubing (such as garden hoses).
- Install with a minimum of 1/2" fire-resistant thermal insulation. Weatherproof the insulation if it might get wet.
- Never use on any pipes that may exceed 150°F (65°C).
- Do not use an extension cord.

General instructions:

- Install only in accessible locations; do not install behind walls or where the cable would be hidden.
- Do not run the heating cable through walls, ceilings, or floors.
- Connect only to outlets that have been installed in accordance with all prevailing national and local codes and standards and are protected from rain and other water.
- Prior to installing the cable, remove any sharp surfaces on the pipe that might damage the heating cable.



3

**Thermal insulation**

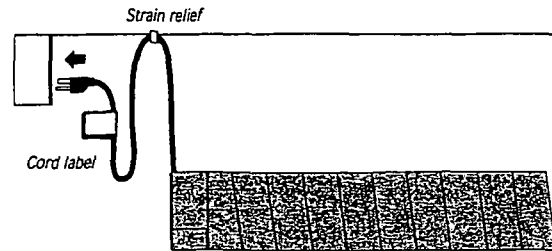
- Before installing the thermal insulation, check to see that the heating cable is free from mechanical damage (such as from cuts or clamps) and thermal damage (such as from solder or overheating).
- Using a megohmmeter, test each circuit according to the "Cable testing and maintenance" instructions below, both prior to and after installing the thermal insulation.

Note:

A reliable Gardian system depends on properly installed and dry, weatherproofed thermal insulation.

- Ensure that at least 1/2" of fiberglass or equivalent thermal insulation is used and that all pipework, including valves, joints, and wall penetrations, has been fully insulated. To minimize the potential for mechanical damage after installation, install the insulation on the pipework as soon as possible.
- Be sure the Gardian W51 label is visible on the outside of the thermal insulation.

4



- To prevent damage to the heating cable or cord, secure the cable with a plastic cable tie, glass cloth tape, or duct tape as shown above.
- Plug the heating cable into a 120-Vac grounded outlet.
- Check the circuit breaker to verify power to the cable.
- Standing water in the pipe should feel warm within an hour.

Cable testing and maintenance

Using a 2500-Vdc megohmmeter, check the insulation resistance between both of the rectangular (power) prongs on the plug and the round (ground) prong after installing the heating cable. Minimum reading should be 1000 megohms.

The installer should record the original values for each circuit. Subsequent readings taken during regular maintenance schedules should be compared to the original value.

If the readings should fall below 1000 megohms, replace the Gardian W51 cable with a new unit. Do not attempt to repair the unit.

⚠ WARNING!

Damaged heating cable can cause electrical shock, arcing, and fire. Do not attempt to repair or energize damaged heating cable. Remove it at once and replace with a new length.

W51 Heating Cable Installation Instructions

Product specifications

	W51-6P	W51-12P	W51-18P	W51-24P	W51-50P	W51-75P	W51-100P
Cable length in feet (meters)	6 (1.8)	12 (3.7)	18 (5.5)	24 (7.3)	50 (15.2)	75 (22.8)	100 (30.5)
Min. thermal output on a pipe at 40°F/5°C (watts)	30	60	90	120	250	375	500
Min. thermal output on a pipe at 0°F/-18°C (watts)	46	92	138	184	385	578	770
Max. current draw on a pipe at 40°F/5°C (amps)	0.33	0.65	0.98	1.30	2.71	4.07	5.42
Max. current draw on a pipe at 0°F/-18°C (amps)	0.50	1.01	1.51	2.02	4.20	6.30	8.40

General specifications for all W51 products

Nom. cable width (in/mm)	0.34 (8.5)
Nom. cable thickness (in/mm)	0.23 (5.8)
Cable bus wire gauge (AWG)	20
Cold lead length (in/mm)	30 (750)
Nominal service voltage (Vac)	110-120
Plug type	Three-prong
Circuit breaker sizing	15 A maximum
Ground-fault protection	5 mA or 30 mA
Max. exposure temperature	150°F (65°C)
Electrical classification	Ordinary areas only
Exposure to chemicals	None

545
7.5
6258
PACIFIC TIME

Important: All information, including illustrations, is believed to be reliable. Users, however, should independently evaluate the suitability of each product for their application. Raychem makes no warranties as to the accuracy or completeness of the information, and disclaims any liability regarding its use. Raychem's only obligations are those in the Raychem Standard Terms and Conditions of Sale for this product, and in no case will Raychem or its distributors be liable for any incidental, indirect, or consequential damages arising from the sale, resale, use, or misuse of the product. Specifications are subject to change without notice. In addition, Raychem reserves the right to make changes—without notification to Buyer—to processing or materials that do not affect compliance with any applicable specification.

Gardian is a trademark of Raychem Corporation.

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Fax (800) 457-5995
Fax-on-Demand (800) 901-8107
ciinfo@raychem.com
www.raychem.com

Raychem Canada Limited
Toronto, Ontario
Canada
Tel (800) 545-6258
Fax (650) 361-5579

DUAL SOCK FILTERS

OPERATING INSTRUCTIONS

LIQUID BAG MODELS 44, 66, 88

READ THE WARNING/SAFETY INFORMATION ON BACK BEFORE PROCEEDING

WARNING-SAFETY INFORMATION

- 1.) The housings in this catalog, if improperly used, can cause serious injury or death.
- 2.) Always wear proper protective clothing for the liquid being filtered. Check your M.S.D.S. for any instructions or suggestions.
- 3.) Do not run housing in excess of the rated pressure or temperature found on the housing tank label. (See warning #1)
- 4.) Check chemical compatibility of selected o-ring and housing material before housing installation.
- 5.) Do not open a housing when the system is under pressure; always relieve all pressure through housing before opening of housing lid.
- 6.) Stop all flow of liquid before opening of lid.
- 7.) Bolt housing to floor, as tipping may occur when lid is opened.

Krystil Klear Filtration

Div. Of GMD

9449 S. 550 West

Winamac IN. 46996

Ph.(800) 869-0325 Fax (574) 278-7115

The housing you have purchased is manufactured with the highest quality materials and with the greatest pride to offer you a superior in-line housing for industrial applications.

If there is any damage to the housing or element, a **CLAIM MUST BE FILED WITH THE FREIGHT CARRIER. SHIPPER WILL NOT ACCEPT RETURNS WITHOUT PRIOR AUTHORIZATION, UNAUTHORIZED SHIPMENTS WILL BE REFUSED.**

A. RECEIVING INSTRUCTIONS

1. Unpack the housing(s) and discard any shipping materials.
2. Place housing in the desired location on a flat surface. Secure support legs to the base if applicable.

B. INSTALLATION INSTRUCTIONS

****flow to the housing should be turned off****

1. Place housing on pipe connections:
 - a. **N.P.T. / Coupling style** - Krystil Klear does not recommend using any type of liquid sealant due to contamination of the pipe that may occur.
 - b. **Flange style** - put a small amount of clean, heavy oil on one side of the gaskets, place oiled side down onto existing flanges to hold gaskets.
2. Please note the labeling of the inlet and outlet connections for proper installation. Tighten housing with proper tension to seal housing on existing pipe or flange. Note: housing has been factory pressure tested to assure a leak proof vessel. If leaking occurs, check for improper connections.
3. Remove lid from housing by turning eye nuts until loosened and swing them down. Using the Lid Lift Handle, swing the lid until full view of the inner housing area is gained.
4. Check inner housing and pipe connections for foreign material and discard any items that have entered during shipping or unpacking.
5. Make sure that the strainer baskets are pushed fully into housing grooves. If using a filter bag, seat bag fully into strainer basket to assure a leak-proof seal between bag and basket. For best results, bag should be fully extended into the basket.
6. Close lid and alternately tighten the eye nuts until lid is fully seated onto the

O-Ring gasket.

7. Housing is now ready for start-up.

C. START-UP OF HOUSING

1. Loosen vent plug to allow air to escape from housing
Slowly open the inlet to gradually fill the housing body.
2. When housing body is full (liquid escapes from top vent), close the vent.
3. Open the outlet connection and fully open the inlet connection.
Housing is now operating properly

D. REMOVAL OF SPENT ELEMENT:

1. When the housing reaches your pre-determined differential pressure, stop flow to the housing and relieve housing pressure through housing drain. Remove enough liquid to show top of basket flange.
2. Loosen eye nuts on housing and, using the Lid Lift Handle, swing the lid to gain full access to the inside of housing.
3. If using a liquid bag, pull the element out of basket and discard the element in accordance with any required local and federal laws.
4. Remove filter baskets and clean thoroughly.
5. Housing debris and sludge should be removed to prolong filter efficiencies.
6. Replace filter baskets and bags into housing as noted in B-5 thru C-3 above.

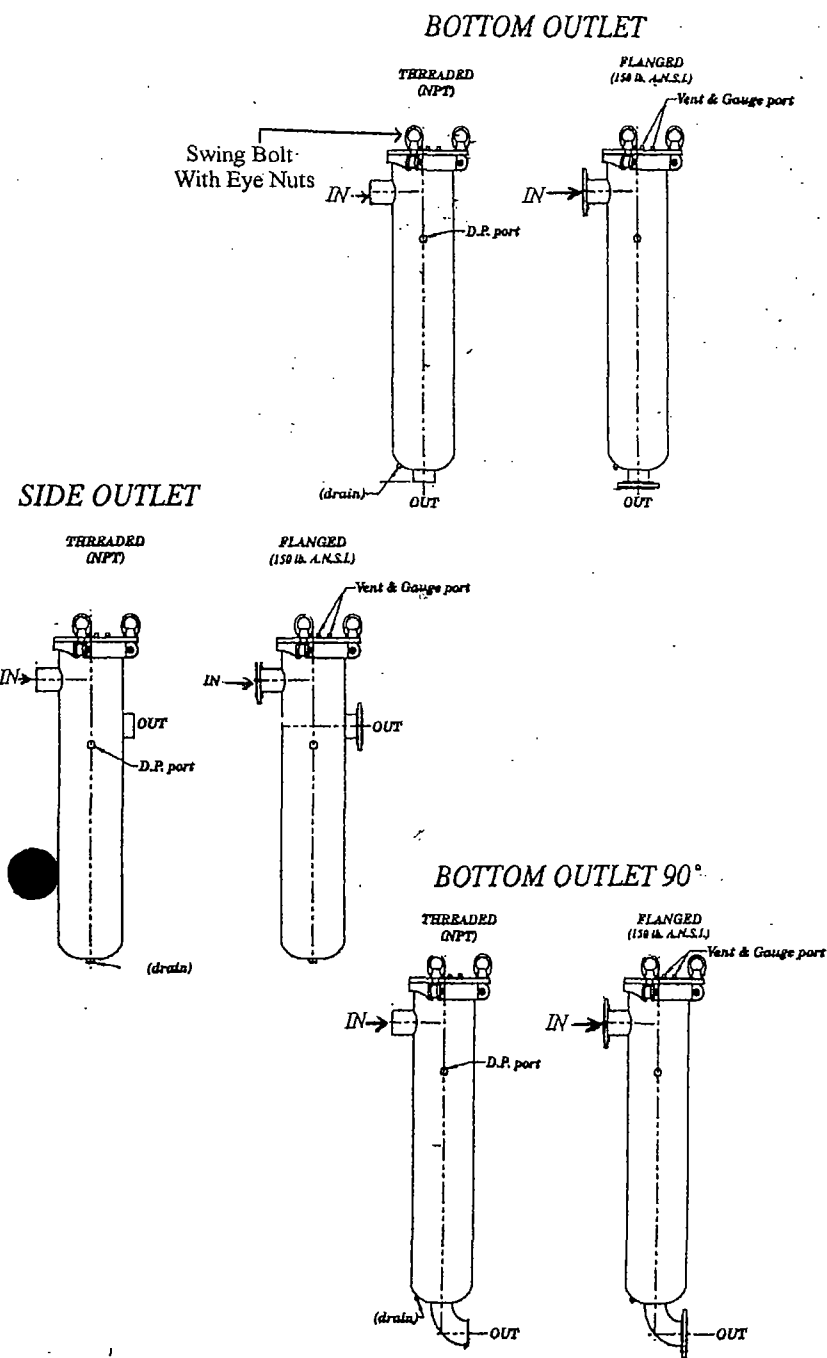
C. RECOMMENDED MAINTENANCE

Periodic checks should be made on all housing lid and basket o-rings to ensure no cuts or damage has incurred that would cause the housing not to seal. If housing parts become damaged or worn, replace immediately.

PART NUMBER	DESCRIPTION
* LV	Viton Lid O-ring
88BV	Viton Basket O-ring
*LGCA	18" Tri-Pod Leg Assembly Carbon Steel
*LGSS	18" Tri-Pod Leg Assembly Stainless
EN	Eye Nut
RE	Rod End
CBA	Clevis Bolt Assembly
*LDCA	Lid Cover Carbon Steel
*LDSS304	Lid Cover Stainless Steel
PER APPLICATION **	Filter Bags
PER APPLICATION **	Filter Basket

* insert first two digits of housing model # (44,66, or 88)

** Full line of replacement bags and baskets available



BUILDING / SYSTEM
SECURITY
SITE MONITORING

***INDUSTRIAL HIGHWAY SITE SECURITY SYSTEM**

IMPORTANT!

PROPER INTRUSION PROTECTION

For proper intrusion coverage, sensors should be located at *every possible point of entry* to a home or commercial premises. This would include any skylights that may be present, and the upper windows in a multi-level building.

In addition, we recommend that radio backup be used in a security system so that alarm signals can still be sent to the Central Monitoring Station in the event that the telephone lines are out of order (alarm signals are normally sent over the phone lines).

EARLY WARNING FIRE DETECTION

Early warning fire detection is important in a home. Smoke and heat detectors have played a key role in reducing fire deaths in the United States. With regard to the number and placement of smoke/heat detectors, we subscribe to the recommendations contained in the National Fire Protection Association's National Fire Alarm Code (NFPA 72). These recommendations can be found on page 47 of this manual.

About This Manual

This manual is a step-by-step guide that will acquaint you with the system's features and benefits. It defines the components and their functions, describes their operation, and provides clear step-by-step instructions for normal and emergency procedures. Keep this manual in a convenient place so that you can refer to it as necessary.

INDUSTRIAL HIGHWAY SITE

SECURITY SYSTEM ZONES

Zone 1 System Down Alarm

Zone 2 Service Door Alarm

Zone 3 Overhead Door Alarm

Zone 4 Motion Alarm

Zone 5 Fire Alarm

Zone 9 Temperature Alarm

Zone 10 Valve Tamper Alarm

“Emergency 24” Contact Phone # 1-(800)-877-3624

Account # MOOOO5

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System Overview

Introduction

Congratulations on your ownership of an ADEMCO Security System. You've made a wise decision in choosing it, for it represents the latest in security protection technology today, and millions of premises are protected by ADEMCO systems. This system provides:

- Three forms of protection: burglary, fire* and emergency
- At least one keypad which provides control of system and displays system status
- Various sensors for perimeter and interior burglary protection
- Smoke or combustion detectors* designed to provide early warning in case of fire.

Your system may also have been programmed to automatically send alarm or status messages over the phone lines to a Central Monitoring Station.

** Commercial installations and some residential systems may not include fire protection – check with your installer.*

NOTE: The features and procedures described in this manual apply to both the VISTA-20P/PS Series and VISTA-15P Series security systems. Differences are noted where applicable.

System Basics

Burglary Protection

- Several modes of burglary protection: Stay, Night-Stay, Away, Instant, Maximum.
STAY: arms perimeter zones only and entry delay is on
INSTANT: same as STAY, except entry delay is off
NIGHT-STAY: arms perimeter zones and selected interior zones; entry delay on
AWAY: arms perimeter and all interior zones, entry delay is on
MAXIMUM: same as AWAY, except entry delay is off
- You can BYPASS selected zones while leaving the rest of the system armed.
- CHIME mode alerts you to the opening of protected doors and windows while the system is disarmed.

Fire Protection

- Fire protection is always active (if installed) and an alarm sounds if a fire condition is detected
- If necessary, you can manually initiate a fire alarm using the keypad (if programmed).
- Refer to the Fire Alarm System section for information regarding fire protection, smoke detectors and planning emergency exit routes.

Security Codes

- You were assigned a 4-digit security code during system installation.
- Use your security code when arming and disarming the system, and when performing other system functions.
- Other users can be assigned different security codes, each with different authority levels, which define the system functions a particular user can perform.

System Overview (cont'd)

Zones and Partitions

- The system sensing devices have been assigned to various “zones,” which are specific areas of protection (e.g., front door, kitchen window, etc.).
- Zone numbers are displayed at the keypad when an alarm or trouble condition occurs on a sensor.
- Partitions (VISTA-20P/PS Series) provide two independent areas of protection, with each partition containing a group of zones that can be armed and disarmed without affecting other zones or users.
- Partitioned systems (VISTA-20P/PS Series) can include a common zone area, which is an area shared by users of both partitions (such as a lobby in a building).

Arming, Step-Arming and Disarming Burglary Protection

- The system must be armed before the burglary protection can sense intrusions.
- To arm your system, enter your user code followed by the desired arming key.
- If programmed, the [#] key can be pressed instead of entering the security code when arming the system.
- You can also use the step-arming feature if programmed, to arm the system. This is a function key that allows you to arm the system in one of three modes by simply pressing the key repeatedly.
- To disarm the system, enter your user code, then press the [OFF] key.

Alarms

- When an alarm occurs, both the keypad and external sounders will sound, and the keypad will display the zone(s) causing the alarm.
- If your system is connected to a Central Monitoring Station, an alarm message will also be sent.
- To stop the alarm sounding, simply disarm the system.

Memory of Alarm

- When an alarm condition occurs, the keypad displays the number(s) of the zone(s) that caused the problem, and displays the type of alarm.
- The message remains displayed even after disarming the system, but can be cleared with another “off” sequence.

Function Keys

- The “A,” “B,” “C,” and “D” keys on the keypad can be programmed to perform various functions.
- Functions include: activate a panic alarm, arm the system, provide step arming, switch lights on/off, send a message to a pager, display Time/Date, and start a programmed Macro sequence.

Phone Access

- If included, a phone module permits you to access the system via a touch-tone phone, either on-premises or by call-in when away.
- When you call in, the phone module announces system status over the telephone, and you can arm/disarm the system and perform most function commands remotely using the telephone keys.
- Complete information for using these features is provided with the voice module.

System Overview (cont'd)

Paging Feature

- If programmed, the system can automatically send certain system condition messages to up to four (VISTA-20P/PS Series) or two (VISTA-15P Series) pagers.
- The display consists of code numbers that indicate the type of condition that has occurred.

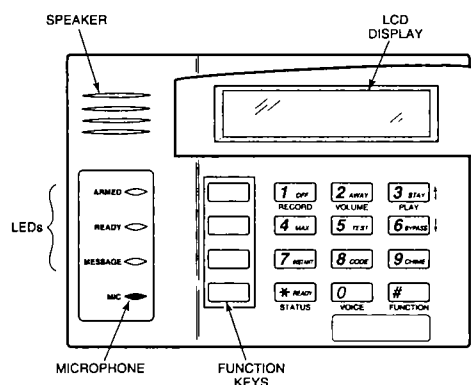
Scheduling

- Your system can be programmed to automatically perform certain functions (e.g., arm the system) at a predetermined time each day.

Using the Voice Message Center

Voice keypads feature a voice message center that lets you record and playback one message.

- The message can be up to 2.5-minutes long
- The message remains in the Keypad's memory until a new message is recorded.
- The volume control of the message is adjustable.
- Refer to the procedures below when using the Message Center functions.



Message Center Functions

To...	Press these keys...	Notes...
record a message	# [] + 0 [] + 1 OFF FUNCTION VOICE RECORD	The red MESSAGE LED lights. Message remains in memory until a new message is recorded.
end recording	1 OFF RECORD	The red MESSAGE LED flashes, indicating message waiting.
play a message	# [] + 0 [] + 3 STAY FUNCTION VOICE PLAY	The recorded message plays and the red MESSAGE LED turns off.
adjust the volume	# [] + 0 [] + 2 AWAY FUNCTION VOICE VOLUME, then press volume key [3] ↑ (up) or [6] ↓ (down)	Adjusting message volume also adjusts status volume. Volume cannot be adjusted while playing.

About The Keypads

General Information

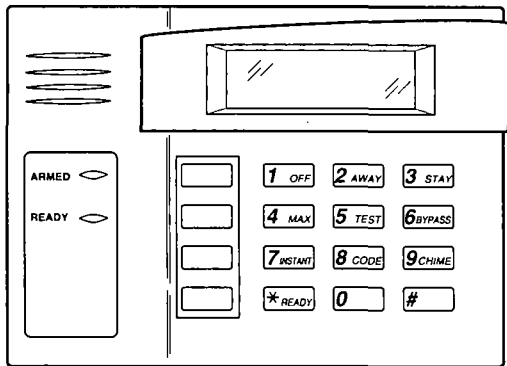
Your keypads allow you to control all system functions and feature the following:

- A telephone style (digital) keypad
- Liquid Crystal Displays (LCD) that show the nature and location of all occurrences
- Built-in sounder that sounds during alarms and troubles. The sounder also "beeps" during certain system functions and also when depressing any of the keys (to acknowledge the key press).
- Backlighting of the LCD display windows. Backlighting turns on when any key is pressed or when entering the premises through any assigned entry/exit door. This feature is helpful when a keypad is located in a dimly lit area.
- Some keypads have a voice feature that announces the nature and location of all system occurrences. Voice keypads also announce any faulted entry/exit or perimeter zone when Chime mode is on. Ask your installer if this option has been programmed for your system.

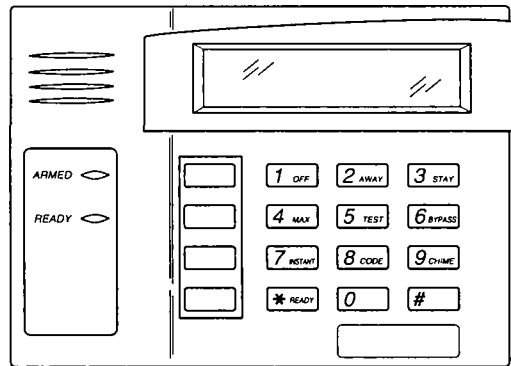
IMPORTANT: If the keypad beeps rapidly upon entering the premises, it indicates that an alarm has occurred during your absence and an intruder may still be on the premises. LEAVE IMMEDIATELY and CONTACT THE POLICE from a nearby safe location.

Alpha Display	2-line alpha display keypads feature a 2-line, 32-character alphanumeric LCD that displays system messages in friendly English. These keypads can also be programmed with custom zone descriptors.
Fixed-Word Display	Fixed-Word display keypads are functionally identical to Alpha display keypads, but the LCD display uses pre-designated words to identify the nature and location of occurrences.

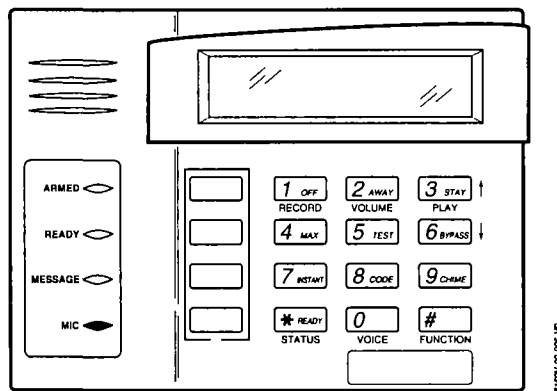
About The Keypads (cont'd)



Standard Fixed-Word Display Keypad



Standard Alpha Display Keypad



Voice-Capable Alpha Display Keypad

About The Keypads (Cont'd)

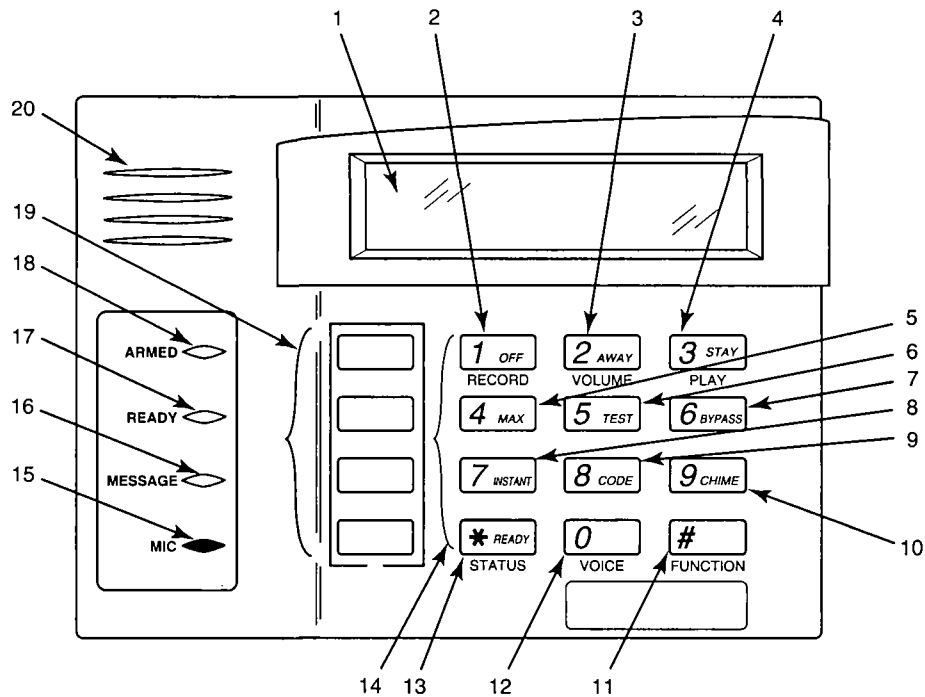
FIXED-WORD DISPLAY KEYPAD

- AWAY:** All burglary zones, interior and perimeter, are armed.
- STAY:** Perimeter burglary zones, such as protected windows and doors, are armed.
- NIGHT-STAY:** When specific interior zones are armed and all others bypassed, the NIGHT and STAY indicators are both on.
- INSTANT:** Entry delay is turned off:
Lit with STAY = Instant mode
Lit with AWAY = Maximum mode
- BYPASS:** This appears when one or more burglary protection zones have been bypassed.
- NOT READY:** Appears when burglary portion of the system is not ready for arming (due to open protection zones). The system is ready to arm when this message disappears and the READY indicator light comes on.
- NO AC:** Appears when AC power has been cut off. System is operating on backup battery power.
- AC:** Appears when AC power is present.
- CHIME:** Appears when the chime feature is activated.
- BAT:** Low battery condition in a wireless sensor (if zone number displayed) or low system battery (if no zone number displayed).
- ALARM:** Appears when an intrusion has been detected and the system is armed (also appears during a fire alarm or audible emergency alarm). Accompanied by the protection zone in alarm.
- CHECK:** Appears when a malfunction is discovered in the system at any time, or if an open is detected in a fire zone at any time, or a fault in a DAY/NIGHT burglary zone during a disarmed period. Accompanied by a display of zone number in trouble.
- FIRE:** Appears when a fire alarm is generated. Accompanied by a display of the zone in alarm.
A FIRE display also appears when a fire alarm is manually activated, accompanied by a display of emergency key zone number programmed for fire.
- CANCELED:** Appears when an alarm has been silenced by the Code + OFF sequence and will remain on until another Code + OFF sequence is keyed.



FIXED-WORD DISPLAY

Functions of the Keypads



Voice-capable 2-line Alpha keypad
(shown with flip-down front door removed)

IMPORTANT!

- Match the numerical callouts in the above graphic with the corresponding number on the following pages for a description of usage.
- When entering codes and commands, sequential key depressions must be made within 4-5 seconds of one another. If 4-5 seconds elapse without a key depression, the entry will be aborted and must be repeated from its beginning. Be sure to observe this precaution when performing any of the procedures in this manual.
- If you make a mistake while entering a **security** code, stop, press the [*] key, and then start over. If you stop in the middle while entering a code, and then immediately start the entry over, an erroneous code might be entered.

Functions of the Keypads (cont'd)

NOTE: The functions printed directly on the keys indicate their primary purpose; the functions printed under some of the keys (shown in brackets under the respective key), indicate their alternate or secondary purpose.

1. DISPLAY WINDOW

Alpha Display Keypads: 2-line, 32-character Liquid Crystal Display (LCD) keypads that display protection point identification, system status, and messages.

Fixed-Word Display Keypads:

Display protection zone ID and system status messages using pre-designated words in the LCD display area.

2. **[1 OFF]** Disarms burglary portion of the system, silences alarms and audible trouble indicators, and clears visual display after problem's correction.
[RECORD] On Voice keypads, used in conjunction with the FUNCTION and VOICE keys to record up to a 2.5-minute message.
3. **[2 AWAY]** Arms the entire burglary system, perimeter and interior.
[VOLUME] On Voice keypads, used in conjunction with the FUNCTION and desired volume control keys ↑ [3] or ↓ [6] to adjust the volume of a recorded message or voice system status.
4. **[3 STAY]** Arms perimeter portion of burglary system only. Interior protection is not armed, allowing movement within premises without causing an alarm.
- [PLAY]** On Voice keypads, used in conjunction with the FUNCTION and VOICE keys to play the recorded message.
- [↑]** On Voice keypads, used in conjunction with the FUNCTION and VOLUME keys to raise the message and voice system status volume.
5. **[4 MAX]** Arms the entire burglary system, perimeter and interior, but without entry delay feature. Entering via an entry/exit door will cause an alarm.
6. **[5 TEST]** Tests the system and alarm sounder if disarmed. Refer to *Testing The System* section for test procedures.
7. **[6 BYPASS]** Removes individual protection zones from being monitored by the system.
[↓] On Voice keypads, used in conjunction with the FUNCTION and VOLUME keys to lower the message and voice system status volume.
8. **[7 INSTANT]** Arms in manner similar to the STAY mode, but without the entry delay feature.
Entering via an entry/exit door will cause an alarm.
9. **[8 CODE]** Used to assign additional user codes for other users of the system.
10. **[9 CHIME]** Turns CHIME mode on and off. When on, the opening of windows or doors while the system is disarmed will sound 3 beeps at the keypad(s).

Functions of the Keypads (cont'd)

- 11. **#** This key can be used for "Quick Arming" of the system without use of a security code (if programmed).
[FUNCTION] On Voice keypads, enables the desired voice or volume function.
- 12. **0**
[VOICE] On Voice keypads, enables the RECORD, VOLUME and PLAY functions.
- 13. *** READY** Used to display all open protection zones.
[STATUS] On Voice keypads, a momentary press of the STATUS key annunciates the current system status. Pressing the STATUS key a second time annunciates and displays system and/or zone faults (if they exist).
- 14. **KEYS 0-9:** Used to enter your security code(s) and to perform their associated system functions after the security code has been entered.
- 15. **MIC**
On voice keypads, microphone for Message Center recordings.
- 16. **MESSAGE LED INDICATOR: (RED)**
On Voice keypads, flashes red when message waiting or lights red (steady) when in record mode.
- 17. **READY LED INDICATOR: (GREEN)**
Lit when the system is ready to be armed (no faults present). While the system is disarmed, this indicator will go on and off as protection zones are closed and opened.
- 18. **ARMED LED INDICATOR: (RED)**
Lit when the system has been armed.
- 19. **FUNCTION KEYS:** Keys A, B, C, D may have been programmed for a variety of functions, including panic (emergency) functions. For details, see the *Function Keys* section.
- 20. **INTERNAL SPEAKER:** The built-in speaker mimics the alarm sounder during alarms, and will also "beep" during certain system functions. The speaker also provides voice playback for any recorded messages.

Entry/Exit Delays

Entry Delay

Entry Delays give you time to disarm the system when you re-enter through the designated entrance door. You must disarm the system before the entry delay period ends, or an alarm will occur. The keypad beeps during the entry delay period, reminding you to disarm the system. There are two entry delays (if programmed). The first is for your primary entrance and the second can be used for a secondary entrance, where a longer delay is required to walk to the keypad to disarm the system.

You can also arm the system with no entry delay at all by using the INSTANT or MAXIMUM arming mode. This mode provides greater security while on the premises or while away for extended periods of time.

See your installer for your delay times.

Partition 1 _____

Exit Delay: seconds

Entry Delay 1: seconds

Entry Delay 2: seconds

NOTE: Entry/Exit times set for partition 1 also apply to the Common Zone of the VISTA-20P/PS Series.

Partition 2 (on VISTA-20P/PS Series only) _____

Exit Delay: seconds

Entry Delay 1: seconds

Entry Delay 2: seconds

Exit Delay

Exit delay gives you time to leave through the designated exit door without setting off an alarm. Exit delay begins immediately after arming your system in any arming mode and Alpha Display keypads display the message "You May Exit Now." When "You may exit now" disappears, the system is fully armed. If programmed, a slow beeping will sound during the exit delay period until the last 10 seconds, which then changes to fast beeping (alerting you to the end of exit delay). If you cannot leave within this delay time period, you should stop, disarm the system, and start over to avoid a false alarm.

Exit Delay Restart (if programmed): If you wish to open the entry/exit door to let someone in after arming STAY, you can restart the *exit* time delay at any time – **simply press the [*] key**, then let that person in. The system automatically rearms when the exit delay expires, thereby avoiding having to disarm the system and then rearm it again.

Additionally, when the system is armed AWAY, reopening and closing the entry/exit door **before** exit delay time expires (e.g., re-entering to get a forgotten item), will reset the exit delay time.

Entry/Exit Delays (cont'd)

Exit Alarms

Whenever you arm the system, the exit delay begins. If an entry/exit door or interior zone is faulted when the exit delay ends (e.g., exit door left open), the system sounds an alarm and starts the entry delay timer. If you disarm the system before the entry delay ends, the alarm sound stops and the message "CANCELED ALARM" or "CA" is displayed on the keypad, along with a zone number indicating the faulted zone. No message is sent to the Central Monitoring Station.

To clear the exit alarm condition, the open zone must be made intact; to clear the display, enter your 4-digit code plus OFF.

If you do not disarm the system before the entry delay ends, and an entry/exit door or interior zone is still open, the alarm sound continues and an "exit alarm" message is sent to the Central Monitoring Station. The message "EXIT ALARM" or "EA" is displayed on the keypad, along with a zone number indicating the faulted zone. To stop the alarm, the system must be disarmed (your code plus OFF); to clear the display, enter your code plus OFF a second time.

An "exit alarm" also results if an entry/exit door or interior zone is faulted within two minutes after the end of the exit delay.

Your system may have been programmed for this feature to minimize false alarms sent to the Central Monitoring Station. Ask your installer if "Exit Alarm" is active in your system. If so, check this box. <input type="checkbox"/>

Checking For Open Zones

Using the [*] Key to Display and Announce System Status

Before arming your system, all protected doors, windows and other protection zones must be closed or bypassed; otherwise the keypad will display a "Not Ready" message.

Use the READY key to display all faulted zones, making it easier for you to identify and secure any open zone.

1. Press [*] (do not enter code first) to display faulted zones.
2. Secure or bypass the zones displayed.
The keypad's READY indicator lights when all protection zones have been either closed or bypassed.
3. Arm the system as desired.

Alpha Display:

DISARMED - PRESS *
TO SHOW FAULTS

Fixed-Word Display:

Zone no. and "NOT READY"

Voice Status: Voice keypads (if installed), can announce system status and faulted zones (up to 3 zone descriptors) if the Voice Status feature is turned on.

To turn the Voice Status feature on/off: Press the following keys:
[#] + [0] + [2] + [4] (also turns on Voice Chime mode; see *Chime mode* section)

To announce Status: Press [*] STATUS key once.

To announce faulted zones: Press the [*] STATUS key a second time within 5 seconds of the first press.

Arming the System

STAY Mode: Arms Perimeter Only, Entry Delay On

- Used when you want to arm the system with persons staying inside (or if you have pets that are moving throughout the premises).
- The perimeter sensors are armed, but interior sensors are left disarmed.
- Exit delay begins (you can leave through the entry/exit door, if desired).
- An alarm sounds if any protected window or non-entry/exit door is opened.
- You may otherwise move freely within the premises.
- Persons entering later can enter through an entry/exit door, but they must disarm the system within the *entry* delay period to avoid sounding an alarm.

NIGHT-STAY Mode: Arms Perimeter Only, Plus Selected Zones

- Use NIGHT-STAY mode to provide increased security while staying inside.
- Arms same as STAY mode, but also arms preselected interior sensors (programmed by your installer), while other interior sensors are left disarmed.
- Persons entering later can enter through an entry/exit door but they must disarm the system **and** must not violate any of the programmed interior zones to avoid sounding an alarm.
- **IMPORTANT:** When NIGHT-STAY mode is on, the selected interior zones are armed and cause an alarm if anyone enters those areas (e.g., waking in the middle of the night). To avoid sounding an alarm, you must disarm the system before any activity takes place in those interior zones.

INSTANT Mode: Arms Perimeter Only, Entry Delay Off

- Used when staying inside and do not expect anyone to use an entry/exit door.
- Arms same as STAY mode.
- An alarm sounds immediately if any protected perimeter window or any door is opened, including entry/exit doors.
- **IMPORTANT:** Arming the system in this mode greatly increases the chance of false alarms. Use extreme care in selecting this mode of arming.

AWAY Mode: Arms Entire System, Entry Delay On

- Used when nobody will be staying inside (including pets).
- The entire system (interior and perimeter) is armed.
- Exit delay begins letting you leave through the entry/exit door.
- An alarm sounds if a protected window or any door is opened, or if any movement is detected inside your premises.
- You can re-enter through an entry/exit door, but you must disarm the system within the *entry* delay period to avoid sounding an alarm.

MAXIMUM Mode: Arms Entire System, Entry Delay Off

- Used when leaving the premises for extended periods (e.g., vacation).
- Arms same as Away mode, but entry delay is off.
- An alarm sounds same as Away mode, and sounds upon opening entry/exit doors.

Arming the System (cont'd)

Arming Commands

Before arming, close all perimeter doors and windows and make sure the Ready to Arm message is displayed.

Mode	Press these keys...	Keypad Confirms By...
STAY	security code + 3 STAY	<ul style="list-style-type: none">• three beeps• armed STAY message displayed• red ARMED indicator lights
NIGHT-STAY	security code + 3 STAY + 3 STAY	<ul style="list-style-type: none">• three beeps• NIGHT-STAY message displayed• red ARMED indicator lights
INSTANT	security code + 7 INSTANT	<ul style="list-style-type: none">• three beeps• armed STAY message displayed• red ARMED indicator lights Note that entry delay is turned off.
AWAY	security code + 2 AWAY	two beeps, or, if programmed, beeping for duration of exit delay <ul style="list-style-type: none">• armed AWAY message displayed• red ARMED indicator lights Leave the premises through an entry/exit door during the exit delay period to avoid causing an alarm. The keypad beeps rapidly during the last 5 seconds of the exit delay to warn you that it is ending.
MAXIMUM	security code + 4 MAX	<ul style="list-style-type: none">• same as AWAY (described above) Note that entry delay is turned off.

Quick Arming

If "Quick Arming" was programmed by the installer, the [#] key can be pressed in place of the security code when arming the system in any of the arming modes. **However, the 4-digit security code must always be used to disarm the system.**

Function Key Arming

For any arming command, a function key may have also been programmed for your system. If so, you can press and hold the appropriate function key for 2 seconds to arm the system. See your installer for the designated functions (see **Single Button Arming** section).

Refer to the **Accessing Other Partitions** section for information on multi-partition arming (VISTA-20P/PS Series only).

Arming the System (cont'd)

Single Button Arming

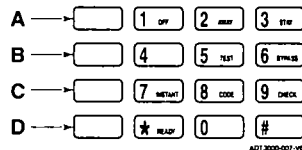
The "A", "B", "C", and/or "D" keys on your keypad may have been programmed for single-button arming. Note that while it is not necessary to use a security code for arming (by using the Quick Arm method described previously), a security code must **always** be used to disarm the system.

If Single-Button Arming is programmed:

- A function key has been assigned to a specific type of arming: STAY mode, NIGHT-STAY mode, AWAY mode, or STEP-ARMING (see Step-Arming paragraph).
- You DO NOT need to enter your user code before pressing the function key but you always need your user security code to DISARM the system.

Before arming, close all perimeter doors and windows.

1. Press and hold the assigned function key for 2 seconds (no code is required). Function keys are shown below.



Alpha Display:

DISARMED
READY TO ARM

Fixed-Word Display: Green LED lit

2. The keypad begins beeping and displays the armed message. The red ARMED indicator also lights.

Alpha Display:

ARMED***AWAY***
YOU MAY EXIT NOW

Fixed-Word Display: AWAY

Single Button "Step" Arming

Single-Button "Step" arming may be programmed into one of the lettered keys (A, B, C, or D). Check with your installer to see if this has been done in your system.

If Step-Arming is programmed:

- The assigned key provides a choice of three levels of security.
- The selected key can be pressed once, twice, or three times, increasing the level of security with each press, as follows

Key ↓	First Press ↓	Second Press ↓	Third Press ↓
A, B, C, D	Armed-STAY	Armed NIGHT-STAY (if programmed)	Armed-AWAY

Keyswitch

Using the Keyswitch

Your system may be equipped with a keyswitch for use when arming and disarming. Red and green lights on the keyswitch plate indicate the status of your system as follows:

Green Light: Lights when the system is **disarmed and ready** to be armed (no open zones). If the system is disarmed and the green light is off, it indicates the system is not ready (one or more zones are open).

Red Light: Lights or flashes when system is armed in AWAY or STAY mode. See your installer for the meanings of the lit red light:

Lit Steady = system armed AWAY or

system armed STAY and exit delay has expired

Flashing = system armed STAY and exit delay timer active

Rapid flashing = an alarm has occurred (memory of alarm).

Before arming, close all perimeter doors and windows.

To arm in the AWAY mode:

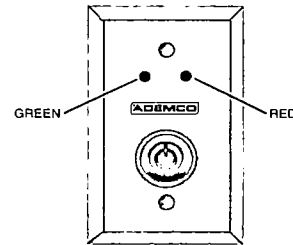
Turn the key to the right for 1/2 second and release. Keypads beep twice and the red indicator lights or flashes.

To arm in the STAY mode:

Turn the key to the right and hold for longer than 1 second, then release. Keypads beep three times and the red indicator lights or flashes.

To disarm the system:

Turn the key to the right and release. The red light turns off



Disarming and Silencing Alarms

Using the [OFF] key

The **OFF** key is used to disarm the system, silence alarm and trouble sounds, and clear alarm memories.

IMPORTANT: If you return and the main burglary sounder is on, DO NOT ENTER, but CONTACT THE POLICE from a nearby safe location.
If you return after an alarm has occurred and the main sounder has shut itself off, **the keypad will beep rapidly upon your entering, indicating that an alarm has occurred during your absence.**
LEAVE AT ONCE, and CONTACT THE POLICE from a nearby safe location.

1. + **1 OFF**

(Security Code)

The “READY” indicator light will be lit if all zones are secure, and the keypad will emit a single tone to confirm that the system is disarmed.

NOTE: If entry delay has started (you’ve opened the entry door), you do **not** need to press the OFF key – simply enter your security code.

Alpha Display:

****DISARMED****
READY TO ARM

Fixed-Word Display: READY

2. **To Silence a Burglary Alarm and Clear a Memory of Alarm**

Enter your **security code** and press the **OFF** key to silence the alarm (or warning tones of a Memory of Alarm).

Note the zone in alarm on the keypad display, and correct the problem (close door, window, etc.). After correcting the problem, enter the security code plus OFF sequence *again* to clear the keypad’s Memory of Alarm display.

3. **To Silence a Fire Alarm and Clear a Memory of Alarm**

Simply press the **OFF** key to silence the alarm. Then enter the **security code** plus **OFF** sequence *twice* to clear the keypad’s Memory of Alarm display. See the *Fire Alarm System* section.

Bypassing Protection Zones

Using the BYPASS Key

Use this key when you want to arm your system with one or more zones intentionally unprotected. The system must be disarmed first.

Vent Zones: Your system may have certain windows set as “vent” zones, which are automatically bypassed if left open when arming the system (you do not need to manually bypass them). However, if a vent zone window is closed **after** arming, it becomes protected and will cause an alarm if opened again while the system is armed.

When bypassing zones:

- The system must be disarmed before you can bypass zones.
- Bypassed zones are unprotected and will not cause an alarm if violated.
- The system will not allow fire zones to be bypassed.
- Zones are automatically unbypassed when the system is disarmed.

1. + **6 BYPASS** + zone numbers (see below)

(Security Code)

Enter the 2-digit zone number(s) for the zone(s) to be bypassed (e.g., 06, 10, 13, etc.). Single digit zone numbers must be preceded by a zero (e.g. 05, 06).

2. When finished, the keypad will momentarily display a "Bypass" message for each bypassed zone number. Wait for all bypassed zones to be displayed.

Arm the system as usual. When armed, the arming message is displayed with “ZONE BYPASSED.”

To display bypassed zones **prior** to arming, enter your security code and press the [6] BYPASS key.

Alpha Display:

DISARMED - PRESS
* TO SHOW FAULTS

Fixed-Word Display:
NOT READY

Alpha Display:

DISARMED BYPASS
READY TO ARM

Fixed-Word Display: BYPASS

Alpha Display:

ARMED: STAY
ZONE BYPASSED

Typical armed display after
bypassing zones.

Bypassing Protection Zones (cont'd)

Quick Bypass

If programmed, "Quick Bypass" allows you to easily bypass all open (faulted) zones without having to enter zone numbers individually. This feature is useful if, for example, you routinely leave certain windows open when arming at night.

1. ☐ ☐ ☐ ☐ + + [#]

(Security Code)

In a few moments, all open zones will be displayed and automatically bypassed. Make sure that only those zones that you wish to leave **unprotected** are bypassed, and that there are no other zones unintentionally left open.

Alpha Display:

DISARMED - PRESS
* TO SHOW FAULTS

Fixed-Word Display: NOT
READY

2. Wait for all bypassed zones to be displayed, then arm the system as desired.

Alpha Display:

DISARMED BYPASS
READY TO ARM

Fixed-Word Display: BYPASS

Ask your installer if "Quick Bypass" is active for your system, and if so, check here: ☐

Chime Mode

Using the Chime Mode

CHIME mode alerts you to the opening of a perimeter door or window while the system is disarmed.

When Chime mode is activated:

- Three tones sound at the keypad whenever a perimeter door or window is opened.
- Interior zones do not produce a tone when they are faulted.
- Pressing the **READY** key will display the open protection points.
- Chime mode can be used only while the system is disarmed.

To turn Chime Mode on:

+ **9 CHIME**

(Security Code)

The CHIME message will appear. Perimeter zones will cause a tone when faulted.

Alpha Display:

DISARMED CHIME
Ready to Arm

Fixed-Word Display: CHIME

To turn Chime Mode off:

+ **9 CHIME**

(Security Code)

The CHIME message will disappear.

Alpha Display:

****DISARMED****
READY TO ARM

Fixed-Word Display: READY

Using the Voice Chime

Voice keypads have a feature that works in concert with the Chime Mode called Voice Chime. Voice chime provides a voice status announcement, chime, and display when any faulted entry/exit or perimeter zone exists. Ask your installer if this option has been enabled for your system.

You may set the voice announcement portion of Voice Chime on or off by pressing the [#] [0] [2] [4] keys (if the normal Chime mode as described above has been turned on). This also toggles the Voice System Status on or off. When off, the keypad's internal sounder will still provide chime if normal Chime mode is on.

Date and Time

Viewing the Current Date and Time

The system lets you view its time and date setting on an alpha keypad.

+ [#] + [6] [3]

(Security Code)

OR,

Press the function key (A, B, C, or D) for viewing current date and time, if programmed.

A typical time/date display is shown.

The display will remain on for about 30 seconds.

Alpha Display:

****DISARMED****
READY TO ARM

TIME/DATE SAT
12:05AM_05/09/00

“A” “B” “C” “D”

If one of the above keys has been programmed for the date/time display feature, place a check mark in the box beneath that key.

Setting the Date and Time

You can set the time and date by doing the following:

1. +[#] + [6] [3]

(Security Code)

Alpha Display:

****DISARMED****
READY TO ARM

2. Press [*] when the time/date is displayed.

A cursor appears under the first digit of the hour.

To move cursor ahead, press []. To go back, press [#].*

- Enter the 2-digit hour setting.
- Enter the 2-digit minute setting.
- Press [1] for PM or [0] for AM.
- Enter the last two digits of the current year.
- Enter the 2-digit month setting.
- Enter the 2-digit day setting.

3. To exit, press [*] when cursor is at the last digit, or wait 10 seconds.

TIME/DATE SAT
04:04PM 10/17/00

Current time display

TIME/DATE SAT
04:04P2000/10/17

Time/date editing display

Panic Keys

Using Panic Keys

Your system may have been programmed to use special keys to manually activate emergency (panic) functions as follows:

This Function	Sends This Signal*	With This Sounding...
Silent Alarm	silent alarm	no audible alarm; displays, "Press [*] to show faults," indicating that a silent alarm has been initiated.
Audible Alarm	audible alarm	a loud, steady alarm at keypad(s) and at any external sounders that may be connected.
Personal Alarm	auxiliary alarm	steady alarm sound at keypad(s), but not at external bells or sirens.
Fire Alarm	fire alarm	temporal (pulsing) sound at external bells and sirens.

*All panic functions send signals to the Central Monitoring Station, if connected.

To activate a Panic Function:

Press and hold down for at least 2 seconds whichever lettered key on the keypad has been programmed for the desired emergency function.

OR

Press both keys of the assigned key pair at the same time.

Normal Alpha Display:

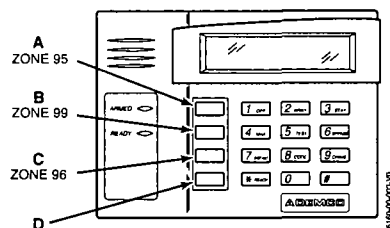
****DISARMED****
READY TO ARM

Fixed-Word Display: READY

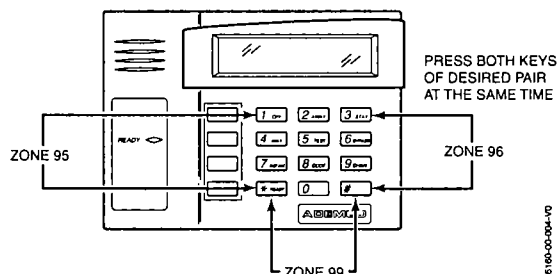
Typical Panic Alpha Display:

ALARM 96 ZONE 96

Fixed-Word Display: 96 and ALARM



Lettered Panic Keys



Panic Key Pairs

See your installer and use the chart provided in the **Features Programmed in Your System** section to note the functions that have been programmed for your system.

Macro Key Programming & Usage

About Macro Keys

The “A”, “B”, “C” or “D” keys can be used to automatically activate a series of commands of up to 16 keystrokes, if programmed for this function. These keystrokes, as a group, are called “macros” and are stored in the system's memory.

- Typical macro functions can include:
 - Arming sequences: STAY, NIGHT-STAY, INSTANT, or AWAY
 - Bypassing particular zone(s)
 - Activating relay(s) for turning on (or off) lights, fans, etc.
- Up to four (VISTA-20P/PS Series) or two (VISTA-15P Series) macros can be assigned – but no more than one macro to a key.
- Macros can be activated only by users with authority levels authorized to perform the macro's function.

NOTE: The installer must activate the desired function key (using *57 Function key Menu Mode) before macros can be assigned.

See the chart at the back of this manual for the key(s) assigned for macros.

1. ☐ ☐ ☐ ☐ + [#] + [6] + [6]

(Security Code)

Alpha Display:

****DISARMED****
READY TO ARM

2. Enter the macro number (1-4 for VISTA-20P/PS Series; 1-2 for VISTA-15P Series) to be programmed at the “Select Macro?” prompt. Remember, only one macro can be assigned to each key.

SELECT MACRO
1-4 0

3. If a macro has been previously defined, the keystrokes are shown on the bottom line of the display; otherwise the display is blank.

MACRO DISPLAY

To exit this mode (and keep the existing macro definition), press any key except the [*] key. The system returns to normal mode.

To define a macro for the selected key, press [*] and continue with the next prompt.

Enter the first of the series of desired commands, (do not include your user code), then press/hold the “D” key for at least two seconds to complete the first command. This key terminates each command, and appears as an “F” in the keypad display.

MACRO PGM

Macro Key Programming & Usage (cont'd)

The keypad beeps to acknowledge your input and displays the command you entered (followed by "F").

4. Enter the next command, followed by press/holding the "D" key for at least two seconds. The keypad beeps and displays the keystrokes entered so far.
5. Repeat until the all the desired commands (up to 16 characters including the "F"s) have been entered.
Be sure to check your keystrokes before continuing. If you made a mistake, you must start over.
6. To exit, press/hold the "D" key for at least two seconds. The display returns to system status and indicates system is ready.

Typical Macro Alpha Display:

MACRO PGM 60203F#701F2F

Example of Macro Programming

Suppose you want to (1) bypass the two upstairs window zones, then (2) turn on an exterior light, and then (3) arm the security system in the AWAY mode. The procedures in the table that follows show you how you would program this macro:

Function	Keystrokes Required	Keypad Display
1. Bypass zones 02 & 03	Press BYPASS [6] key, then 2-digit zone numbers 02 & 03.	60203
2. Insert terminator	Press the "D" key for at least 2 seconds.	60203F
3. Turn light on (device 01)	Press [#] and 7 key for "device ON", and [01] key for selecting device 1.	60203F#701
4. Insert terminator	Press the "D" key for at least 2 seconds.	60203F#701F
5. Arm system AWAY	Press AWAY [2] key.	60203F#701F2
6. Insert terminator	Press the "D" key for at least 2 seconds.	60203F#701F2F

Using a Programmed Macro Key

****DISARMED**** READY TO ARM

ENTER USER CODE * * * *

1. Press the Macro key programmed for the desired series of commands for at least 2 seconds. The "Enter User Code" prompt appears. The prompt remains displayed for up to 10 seconds.
2. Enter your 4-digit user code.
The programmed macro sequence begins automatically after the user code is entered.

Using Device Commands

About Device Commands

Your system may be set up so that it can control certain lights or other devices.

- Some devices may be automatically turned on or off by the system.
- You may be able to override automatically controlled devices using the commands described below.
- Some devices can be manually turned on or off using the commands described below.
- See your installer for a list of devices that may be set up for your system. A list of these devices is provided at the back of this manual for you to fill out.

To Activate Devices:

+ [#] + [7] + 2-digit device number

(Security Code)

Devices associated with that device number activate.

Alpha Display:

****DISARMED****
READY TO ARM

Fixed-Word Display: READY

To Deactivate Devices:

+ [#] + [8] + 2-digit device number

(Security Code)

Devices associated with that device number deactivate.

About Automatic Paging

- The following events can be programmed by your installer to be sent to the pagers: arming and disarming[†], alarms, and trouble conditions. († reports when arming/disarming from a keypad using a security code; auto-arming/disarming, arming with assigned button, and keyswitch arming do not send pager messages.)
- You can also program the system to send an automatic pager message to alert you in the event that someone has not arrived home (disarmed the system) within a defined period of time (see the **Scheduling** section for details on programming a “latch key report”).
- Your installer programs the pager phone numbers and reporting events.
- The pager message consists of a 7-digit system status code that indicates the type of condition that has occurred.
- An optional, predefined 16-digit character string can precede the 7-digit system status code; these characters can consist of a PIN no., subscriber account no., or any additional data that you may wish to have sent to the pager.
- The pager display format is as follows:

AAAAAAAAAAAAAAAA – BBB – CCCC ← 1-digit Partition No. + 3-digit Zone No. **or** User No.

A =	B =	C =
Optional 16-digits for Account numbers, PIN numbers, or any other data; programmed by the installer, if required.	A 3-digit code that describes the event that has occurred in your system (see for event codes table below)	<p>A 1-digit Partition number plus a 3-digit Zone or User number, depending on the type of event that has occurred, where:</p> <ul style="list-style-type: none"> • alarms and troubles display zone number • arming/disarming (opens/closes) display user number

911 =	811 =	101 =	102 =
Alarms. The 4-digit number (CCCC) following this code is the partition no. and <i>zone no.</i> that caused the alarm.	Troubles. The 4-digit number (CCCC) following this code is the partition no. and <i>zone no.</i> that caused the trouble.	Open (system disarmed). The 4-digit number (CCCC) that follows this code is the partition no. and <i>user no.</i> that disarmed the system.	Close (system armed). The 4-digit number (CCCC) that follows this code is the partition no. and <i>user no.</i> that armed the system.

Ex. 2. $\boxed{102-2005}$ = Reporting of a closing-system arming (102)– by user 5 in Partition 2 (2005).

Paging Feature (cont'd)

About Manual Paging

Your system may be set up so you can manually send a message to up to four (VISTA-20P/PS Series) or two (VISTA-15P Series) pagers.

- Your installer programs the paging function key and the pager phone numbers.
- Pressing the paging keys sends the message **999-9999** to the selected pager.
- This message could mean “call home”, “call your office”, or any other prearranged meaning.
- See the Paging chart at the back of this manual for details of the paging setup for your system.

1. Press and hold the programmed Paging Key for at least 2 seconds (wait for beep), then press the pager number* (1-4) representing the pager intended to receive the message.
2. The recipient, on seeing the 999-9999 message, will understand the prearranged meaning of this signal.

** If no number is pressed, the message is sent to pager 1.*

Alpha Display:

****DISARMED****
READY TO ARM

Fixed-Word Display: READY

999-9999

Pager Display

Latch Key Paging

You can program a schedule that causes a pager report to be sent if the system is not DISARMED by the scheduled time (see **Scheduling** section, event “03”). For example, a working parent might want a message to be sent to a pager if their child did not arrive home from school and disarm the system by a certain time.

If programmed, the message that is sent is: **777-7777**.

Security Codes & Authority Levels

About Security Codes

Your installer assigned a master code that is used to perform all system functions. In addition, you can assign different security codes for use by other users (VISTA-20P/PS Series provides 46 additional codes; VISTA-15P Series provides 30 additional codes).

- Only the System Master and Partition Master can assign user codes to users.
- Users are identified by 2-digit user numbers and are pre-assigned to either partition 1 or partition 2 (VISTA-20P/PS Series).
- Only the Installer or System Master can change user partitions.
- In addition to a security code, each user is assigned various system attributes.
- User codes can be used interchangeably within a partition when performing system functions (a system armed with one user's code can be disarmed by another user's code), with the exception of the guest code described below.
- User code programming involves these steps:
 1. Choose a user number from the set of users assigned to the partition in which the user will be operating, and assign a 4-digit security code.
 2. Assign an authority level to that user.
 3. Assign other attributes as necessary (see attributes on the next page).

NOTE: The factory settings are designed to meet most normal user situations. Therefore, the only step you usually need to do when adding users is assign a user number (from the partition's pre-assigned user numbers) and a security code.

Authority Level Definitions

Authority levels define the system functions a particular user can/cannot perform.

Level	Title	Explanation
N/A	System Master (default = 1234)	Reserved for user 02; Can perform all system functions and assign codes in both partitions; can change its own code as follows: <u>Master code + [8] + 02 + new master code + new master code again</u>
0	Standard User:	Can only perform security functions in assigned partition. Cannot perform other system functions.
1	Arm Only:	Can only arm the system. Cannot disarm or do other functions.
2	Guest:	Can arm the system in assigned partitions, but cannot disarm the system unless the system was armed with this code. This code is typically assigned to someone (e.g., babysitter or cleaner) who has a need to arm/disarm the system only at certain times. The user of this code should not use the "Quick Arming" feature.
3	Duress Code:	Intended for use when you are forced to disarm or arm the system under threat. When used, the system will act normally, but can silently notify the Central Monitoring Station of your situation, if that service has been provided.
4	Partition Master	(VISTA-20P/PS Series) Can do everything a standard user can do, and can assign user codes to users in their partition.

Security Codes & Authority Levels (cont'd)

How to Assign User Codes and Attributes

The following lists the various command strings for adding user codes and attributes.

Refer to the User Setup chart at the back of this manual for factory defaults of user attributes and to keep a record of user programming.

NOTE: Partition Master codes (VISTA-20P/PS Series only) apply only to those user numbers previously assigned (by the system master/installer) to the partition master's partition.

Add User Code:

(Users 03/33 are preset to partition programmers, but can be changed.)

System/Partition Master code + [8] + user no. + new user's code

User 01 = installer User 03 = partition 1 master

User 02 = master User 33 = partition 2 master

The Keypad beeps once to confirm that new user was added.

Delete User Code:

System/Partition Master code + [8] + [user no.] + [#] [0]

The user code and all attributes* programmed for this user number, including any associated RF keys, are erased from the system. (*except assigned partition)

Authority Level:

Factory Defaults:

users 04-32/34-49 = 0

users 03/33 = 4

System/Partition Master code + [8] + [user no.] + [#] [1] + auth. level

Authority Levels (see definitions on previous page):

0 = standard user 3 = duress

1 = arm only 4 = partition master (VISTA-20P/PS Series only)

2 = guest only)

Access Group:

Factory Defaults:: none

System/Partition Master Code + [8] + [user no.] + [#] [2] + group (1-8)

You can assign users to a group, then set an access schedule that defines the times this group of users can operate the system. The system ignores these users outside the scheduled times.

User's Partition:

(VISTA-20P only)

Factory Defaults:

Part. 1 = users 03-32

Part. 2 = users 33-49

System Master Code + [8] + [user no.] + [#] [3] + [0] + partition(s) + [#]

This command assigns the partitions the user can access. If more than one, enter partition numbers sequentially, then press [#] to end. E.g., master code + [8] + [user no.] + [#] [3] + [0] + [1] [2] + [#] gives the user access to partitions 1 and 2 and the common partition.

Partition Entries: 1 = partition 1 and common

2 = partition 2 and common

3 = common partition only

RF User Number:

Factory Defaults:: none

Master/Part. Prog. Code + [8] + [user no.] + [#] [4] + zone no.

Use this command to assign a wireless button device (keyfob) to this user (keyfob must be enrolled in system first; see installer).

Zone number: enter the zone number assigned to a button on the keyfob that will be used for arming/disarming by this user.

Pager On/Off:

Factory Defaults:

users 01-04 = 0 (off)

users 05-49 = 1 (on)

Master/Part. Prog. Code + [8] + [user no.] + [#] [5] + 0 or 1

You can program a user so that a message is sent to a pager whenever this code is used to arm or disarm the system.

Paging On/Off: 1 = allow paging; 0 = no paging for this user

Accessing Other Partitions (VISTA-20P)

About Accessing Partitions

(GOTO Command and Multi-Partition Arming)

Each keypad is assigned a default partition for display purposes, and will show only that partition's information.

- If the user is authorized, a keypad in one partition can be used to perform system functions in the other partition by using the **GOTO** command. Refer to the GOTO section.
- If the user is authorized, that user can arm other partitions. Refer to the Multi-Partition Arming section.

The following table shows the relationship of the keypads in each partition when system is armed and disarmed.

	PARTITION 1		PARTITION 2		COMMON ZONE (LOBBY, etc.)	
	Arming State	Keypad Status	Arming State	Keypad Status	Arming State	Keypad Status
Condition 1 ⇔	Disarmed	Partition 1 Only	Disarmed	Partition 2 Only	Disarmed	Common Zone Only
Condition 2 ⇔	Disarmed	Partition 1 and Common Zone	Armed	Partition 2 Only	Disarmed	Common Zone Only
Condition 3 ⇔	Armed	Partition 1 Only	Disarmed	Partition 2 and Common Zone	Disarmed	Common Zone Only
Condition 4 ⇔	Armed	Partition 1 Only	Armed	Partition 2 Only	Armed	Common Zone Only

When both partitions are disarmed, the keypad in each partition displays zone status for its partition only. The common zone keypad shows the status in that zone only. See Condition 1 above.

When partition 1 is disarmed and partition 2 is armed, the keypad in partition 1 shows the status of partition 1 **and** the common zone. Partition 2 will display the status of partition 2 **only**. See Condition 2 above.

When partition 1 is armed and partition 2 is disarmed, the keypad in partition 1 shows the status of partition 1 **only**. Partition 2 will display the status of partition 2 **and** the common zone. See Condition 3 above.

As long as any one of the two partitions is disarmed, the common zone will always be disarmed. The common zone will be armed only when both partition 1 and 2 are armed. See Condition 4 above.

Accessing Other Partitions (cont'd)

Using the GoTo Command (VISTA-20P/PS)

If the user is authorized, a keypad in one partition can be used to perform system functions in the other partition by using the **GOTO** command.

- You must use an Alpha keypad to access another partition.
- Keypads automatically return to their original partition after 2 minutes with no keypad activity.

1. ☐ ☐ ☐ ☐ + [*] + partition number (0,1,2,3)
(Security Code)
0 = return to keypad's original partition.
1 = partition 1; 2 = partition 2; 3 = common zone
The keypad beeps to confirm the partition change.
2. The keypad remains in the new partition until directed to go to another partition, or until it automatically returns to the original partition.
The active partition number is displayed in the upper left portion of screen, if the option is programmed.

Alpha Display:

1 DISARMED
READY TO ARM

Fixed-Word Display: Green LED lit

Alpha Display:

2 DISARMED
READY TO ARM

Fixed-Word Display: Green LED lit

Multi-Partition Arming (VISTA-20P/PS)

Some users can be given Multi-Partition arming ability by being assigned to both partitions when programming user attributes.

When attempting to arm multi-partitions:

- You must use an Alpha keypad.
- The system arms only if all partitions are "ready to arm."
- If any partition is "not ready," the system does not arm at all.
- You can use the GOTO command to bypass open zones before arming.
- If any partition is already armed when global arming is attempted, that partition remains in its existing armed state.

☐ ☐ ☐ ☐ + [0] + arm command (see list below)
(Security Code)

Alpha Display:

1 DISARMED
READY TO ARM

Fixed-Word Display: Green LED lit

Multi-Partition Arming Commands

- 2 = arms all partitions AWAY
- 3 = arms all partitions STAY
- 33 = arms all partitions NIGHT-STAY
- 4 = arms all partitions MAXIMUM
- 7 = arms all partitions INSTANT
- 1 = disarms all partitions

Accessing Other Partitions (cont'd)

Common Zone Operation (VISTA-20P/PS)

Ask your installer if a "common zone" was assigned. If so, check this box ☐

Your system may have been set up to use a common zone, which is an area shared by users of both partitions, such as a foyer or lobby. If so, please note the following:

- The common zone will sound and report alarms only when **both** partitions are armed. If only one partition is armed, the system ignores faults on the common zone.
- Either partition may arm its system if the common zone is faulted, but once armed, the other partition **will not** be able to arm unless the common zone is first bypassed or the fault is corrected.
- Faults on the common zone are displayed on common partition keypads, and will also appear on another partition's keypad when the alternate partition is armed.
- Either partition can clear and restore the common zone after an alarm.
- Entry/exit time for the common zone is the same as for partition 1.

Scheduling

About Scheduling

The system provides end-user schedules (programmable by master/installer only), which can control various types of events.

- Each schedule causes a defined event to start and stop (when appropriate) at a specified time.
- Schedules can be set to automatically repeat at various intervals.
- Schedules can be set for random starting, if desired.
- VISTA-20P/PS Series provides up to 16 user schedules.
- VISTA-15P Series provides up to 4 user schedules.

Creating Schedules

1. + [#] + [6] [4]

(Master Code)

Alpha Displays:

1 DISARMED
READY TO ARM

2. Enter a 2-digit schedule number from:
01-16 (VISTA-20P/PS Series) or 01-04 (VISTA-15P Series).

ENTER SCHED NO.
00=QUIT 00

Press [*] to continue.

3. Enter the desired 2-digit event number from the following list.

ENTER EVENT

00 = clear the scheduled event

01 = turn a programmed output on or off

(see **Using Device Commands** section for a list of output device numbers used in your system)

02 = set a user access schedule for one or more users

(see **Security Codes** section for an explanation of access groups)

03 = send a "latch-key" report to a pager if the system is not disarmed by a specified time; message sent is "777-7777."

04 = automatically arm the system in STAY mode at a specified time

05 = automatically arm the system in AWAY mode at a specified time

06 = automatically disarm the system at a specified time

07 = Display the word "REMINDER" at a specified time

Press [*] to continue.

4. For event number "01," enter the output number associated with this schedule.

DEVICE NUMBER
XX

Otherwise, this prompt is skipped.

Press [*] to continue to the "Start" prompt below.

Scheduling (cont'd)

5. For event number "02," enter the access group number. Otherwise, this prompt is skipped.
Press [*] to continue to the "Start" prompt below.

GROUP NUMBER
X

6. For event numbers "03-07," enter the partition number to be armed or disarmed.
0 = arm all; 1 = partition 1; 2 = partition 2;
3 = arm common
Otherwise, this prompt is skipped.
Press [*] to continue to the "Start" prompt.

PARTITION
X

7. Enter the event's start time and days of week.
Hour = 00-12; minute = 00-59
AM = 0; PM = 1
Days = Position the cursor under the desired days using the [*] key to move forward, then press "1" to select the day.
Press [*] to continue.

START	SMTWTFS
HH:MMAM	1000000

8. Enter the event's stop time, AM/PM and days of week.
Refer to step 7 for available entries.
Press [*] to continue.

STOP	SMTWTFS
HH:MMAM	1000000

9. Enter the desired repeat option.
0 = no repeat
1 = repeat schedule weekly
2 = repeat schedule biweekly (every other week)
3 = repeat schedule every third week
4 = repeat schedule every fourth week
e.g., To make a schedule that happens everyday you would select all days with a repeat count of 1. To make a schedule that runs for one week then stops, select everyday with a repeat count of 0.

REPEAT OPTION
0-4 X

10. Select the randomize option, if desired.
0 = no; 1 = yes
If selected, the schedule times will vary within 60 minutes of the "hour" time. For example, if a schedule is set to start at 6:15pm, it will do so the first time 6:15pm arrives, but on subsequent days it will start anytime between 6:00 and 6:59 p.m.
Press [*] to continue.

RANDOMIZE
0=NO 1=YES X

Event Logging Procedures

About Event Logging

The system records various events in a history log, which can be viewed by the master user on an Alpha Display keypad.

- The Event Log holds up to 100 (VISTA-20P/PS Series) or 50 (VISTA-15P Series) events.
- Events are displayed in chronological order, from most recent to oldest.
- When the log is full, the oldest event is replaced by the logging of any new event.

Viewing the Event Log

1. ☐ ☐ ☐ ☐ + [#] + [6] + [0]
(Master Code)

Alpha Displays:

****DISARMED****
READY TO ARM

2. The system displays the most recent event as follows:
 - event number
 - type of event, identified by its corresponding code (refer to the code table that follows)
 - zone or user number (depending on type of event)
 - partition in which event occurred
 - time and date of the event's occurrence.
3. Pressing [*] displays previous events (back in time).
Pressing [#] displays events forward in time.
4. Exit the event log by pressing any key other than [*] or [#].

001 E441 U001 P1
12:34AM 01/02/00

Understanding the Type of Event Displayed

If the event code is preceded by an E (as in the above display), it means that the event is new and ongoing; if preceded by an R, it means the event has been restored.

Code	Definition
110	Fire Alarm
121	Duress
122	Alarm, 24-hour Silent
123	Alarm, 24-hour Audible

Code	Definition
131	Alarm, Perimeter
132	Alarm, Interior
134	Alarm, Entry/Exit
135	Alarm, Day/Night

Event Logging Procedures (cont'd)

Code	Definition
143	Alarm, Expansion Module
145	ECP Module cover tamper
146	Silent Burglary
150	Alarm, 24-Hour Auxiliary/Monitor zone
162	Carbon Monoxide
301	AC Power
302	Low System Battery/Battery Test Fail
305	System Reset (Log only)
309	Battery Test Failure
321	Bell/Siren Trouble
333	Trouble, Expansion Mod. Supervision
341	Trouble, ECP Cover Tamper
344	RF Receiver Jam
351	Telco Line Fault
353	Long Range Radio Trouble
373	Fire Loop Trouble
374	Exit Error Alarm
380	Global Trouble, Trouble Day/Night
381	RF Supervision Trouble
382	Supervision Auxiliary Wire Zone
383	RF Sensor Tamper
384	RF Sensor Low-battery

Code	Definition
393	Clean Me
401	Disarmed, Armed AWAY, Armed STAY
403	Schedule Arm/Disarm AWAY
406	Cancel by User
407	Remote Arm/Disarm (Downloading)
408	Quick Arm AWAY
409	Keyswitch Arm/Disarm AWAY
441	Disarmed/Armed STAY/INSTANT, Quick-Arm STAY/INSTANT
442	Keyswitch Arm/Disarm STAY
570	Bypass
601	Manually Triggered Dialer Test
602	Periodic Test
606	AAV to Follow
607	Walk Test Entered/Exited
623	Event Log 80% Full
625	Real-Time Clock was Changed (log only)
627	Program Mode Entry (log only)
628	Program Mode Exit (log only)
750 -789	Reserved for Configurable Zone Type report codes (check with central station when using these codes)

NOTE: Ask your installer to explain the meaning of any code you do not understand.

Testing the System

About Testing the System

Using the Test mode allows each protection point to be checked for proper operation. **Testing should be conducted weekly to ensure proper operation.**

- The keypad sounds a single beep every 60 seconds as a reminder that the system is in the Test mode.
 - Alarm messages are not sent to your Central Station while Test mode is on.
1. Disarm the system and close all protected windows, doors, etc. The READY indicator light should come on if all zones are intact (i.e., all protected windows, doors, etc. are closed).

Alpha Displays:
****DISARMED****
READY TO ARM
 2. + then [0] (walk)
(Security Code)
The Dial test (option "1") is intended for the installer and should not be used unless directed to do so by your Security System Representative.

1 = DIAL 0 = WALK
 3. Listen. The external sounder should sound for 1 second and then turn off. If the sounder does not sound, CALL FOR SERVICE.

TEST IN PROGRESS
 4. Fault zones. Open each protected door and window in turn and listen for three beeps from the keypad. Identification (zone number or zone description) of each faulted protection point should appear on the display. The display clears when the door or window is closed.
 5. Walk in front of any interior motion detectors (if used) and listen for three beeps. The identification of the detector should appear on the display when it is activated. The display clears when no motion is detected.
Note that if wireless motion detectors are used, there is a 3-minute delay between activations. This is to conserve battery life.
 6. Test all smoke detectors, following the manufacturer's instructions. The identification of each detector should appear on the display when each is activated. If a problem is experienced with any protection point (no confirming sounds, no display), call for service immediately.
When all protection points have been checked and are intact (closed), there should be no zone identification numbers displayed on the keypad.
 7. Exit test mode: +
(Security Code)

If the test mode is inadvertently left active, it automatically turns off after 4 hours. During the final five minutes, the keypad will emit a double beep every 30 seconds.

Trouble Conditions

"Check" and "Battery" Displays

The word **CHECK** on the keypad's display, accompanied by a "beeping" at the keypad, indicates a trouble condition in the system.

To silence the beeping for these conditions, press any key.

1. **A display of "CHECK" and one or more zone numbers** indicates that a problem exists with the displayed zone(s) and requires your attention. Determine if the zone(s) displayed are intact and make them so if they are not. If the problem has been corrected, the display can be cleared if you enter the OFF sequence (security code plus OFF key) **twice**. If the display persists, **CALL FOR SERVICE**.

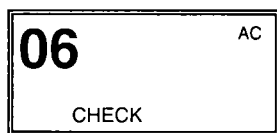
Note: A display of **CHECK 70** on Alpha Display keypads indicates that the wiring connection to the external sounder is at fault (opened or shorted), and you should **CALL FOR SERVICE**. See "BELL FAILURE" on next page. A display of **CHECK 90** indicates that RF interference may be impeding the operation of wireless sensors* in the system. See "**Rcvr Jam**" on next page.

2. **If there are wireless sensors* in your system**, the **CHECK** condition may also be caused by some change in the environment that prevents the wireless receiver from receiving messages from a particular sensor. **CALL FOR SERVICE** if this occurs.

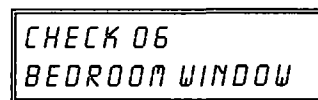
* Not all systems use wireless sensors.

**IF YOU CANNOT CORRECT A "CHECK" DISPLAY,
CALL FOR SERVICE.**

TYPICAL "CHECK" DISPLAYS



FIXED-WORD DISPLAY KEYPAD



ALPHA DISPLAY KEYPAD

Trouble Conditions (cont'd)

Words or letters in parentheses () are those that are displayed on Fixed-Word Display keypads.

Other Trouble Displays

COMM. FAILURE (or **FC**)

Indicates that a failure has occurred in the telephone communication portion of your system.
CALL FOR SERVICE.

* Any "beeping" that accompanies a trouble display can be stopped by depressing any key on the keypad or by entering an OFF sequence (code + OFF)

** Not all systems use wireless sensors.

SYSTEM LO BAT (or **BAT** with no zone No.)

Indicates that a low system battery condition exists. Display is accompanied by "beeping"* at the keypad. If this condition persists for more than one day (with AC present), **CALL FOR SERVICE.**

LO BAT + zone descriptor (or **BAT** with zone No.)

Indicates that there is a low battery condition in the wireless transmitter** number displayed (00 is RF keypad). Accompanied by a single "beep"* (about once every 40 seconds) at the keypad. Either replace the battery yourself, or **CALL FOR SERVICE.** If the battery is not replaced within 30 days, a **CHECK** display may occur.

Rcvr Jam (or **CHECK 90**)

Wireless part of the system is experiencing RF interference which may impede reception from wireless sensors.**

MODEM COMM (or **CC**)

Indicates that the control is on-line with the Central Monitoring Station's remote computer. The control will not operate while on-line. Wait a few minutes — the display should disappear.

BELL FAILURE (or **CHECK 70**)

Indicates that the wiring connection to the external sounder is at fault (open or shorted). Accompanied by "beeping" at the keypad. **CALL FOR SERVICE.**

Trouble Conditions (cont'd)

Other Trouble Displays (Continued)

AC LOSS (or NO AC)

The system is operating on battery power only due to an AC power failure. If only some lights are out on the premises, check circuit breakers and fuses and reset or replace as necessary. If AC power cannot be restored and a "low system battery" message appears (see previous page), **CALL FOR SERVICE.**

Busy-Standby (or dI)

If this message remains displayed for more than 1 minute, system is disabled. **CALL FOR SERVICE.**

OPEN CIRCUIT (or OC)

The keypad is not receiving signals from the control. **CALL FOR SERVICE.**

Long Rng Trbl (or bF)

If part of your system, back-up Long Range Radio communication has failed. **CALL FOR SERVICE.**

TELCO FAULT (or CHECK 94)

The telephone line has a problem. **CALL FOR SERVICE.**

Total Power Failure If there is no keypad display at all, and the READY indicator is not lit, operating power (from AC and back-up battery) for the system has been interrupted and the system is inoperative. **CALL FOR SERVICE.**

In The Event Of Telephone Operational Problems

In the event of telephone operational problems, disconnect the control from the phone line by removing the plug from the phone wall jack. We recommend that your installer demonstrate this disconnection on installation of the system. Do not attempt to disconnect the phone connection inside the control. Doing so will result in the loss of your phone lines. If the regular phones work correctly after the control has been disconnected from the phone wall jack, the control has a problem and you should immediately call for service. If upon disconnection of the control, there is still a problem on the phone line, notify the Telephone Company that they have a problem and request prompt phone repair service. The user may not under any circumstances attempt any service or repairs to the security system. Repairs must be made only by authorized service (see the LIMITED WARRANTY statement for information on how to obtain service).

Maintaining Your System

Taking Care of Your System

The components of your security system are designed to be as maintenance-free as possible. However, to make sure that your system is in reliable working condition, do the following:

1. Test your system weekly.
2. Test your system after any alarm occurs.

Silencing Low Battery Warning Tones at the Keypad

You can silence the keypad's warning tones by pressing the OFF key, but the keypad's low battery message display will remain on as a reminder that you have a low battery condition in one or more of your wireless sensors. When you replace the weak battery with a fresh one, the sensor sends a "good battery" signal to the control as soon as the sensor is activated (opening/closing of door, window, etc.), causing the low battery display to turn off. If the sensor is not activated, the display will automatically clear within approximately 1 hour.

Replacing Batteries in Wireless Sensors

Wireless sensors may not have been used in your security system

IMPORTANT:
Use only batteries recommended by your installer as replacement.

Each wireless sensor in your system has a 9-volt or 3-volt battery. The system detects a low battery in wireless sensors, including smoke detectors, the personal emergency transmitter, and the portable wireless keypad and displays a low battery message*. (A low battery in a portable wireless keypad is detected as soon as one of its keys is pressed, and displayed as **00**.) Battery-operated smoke detectors with a low battery also emit a single "chirp" sound approximately once every 20–30 seconds.

Alkaline batteries provide a minimum of 1 year of operation, and in most units and applications, provide 2–4 years of service. 3-volt lithium batteries provide up to 4 or more years of operation. Actual battery life will depend on the environment in which the sensor is used, the number of signals that the transmitter in the sensor has had to send, and the specific type of sensor. Factors such as humidity, high or low temperatures or large swings in temperature, may all lead to the reduction of actual battery life in an installation.

* The low battery message comes on as a warning that battery replacement in indicated sensor(s) is due within 30 days. In the meantime, a sensor causing a low battery indication is still fully operational.

Routine Care

- Treat the components of your security system as you would any other electrical equipment. Do not slam sensor-protected doors or windows.
- Keep dust from accumulating on the keypad and all protective sensors, particularly on motion sensors and smoke detectors.
- The keypad and sensors should be cleaned carefully with a dry soft cloth. **Do not spray water or any other fluid on the units.**

Fire Alarm System

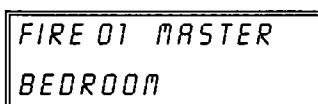
THIS SECTION APPLIES ONLY TO RESIDENTIAL SYSTEMS

General Your fire alarm system (if installed) is on 24 hours a day, for continuous protection. In the event of an emergency, the strategically located smoke and heat detectors will sound their alarms and automatically send signals to your system, triggering a loud, interrupted pulsed sound* from the Keypad(s) and any external sounders. A FIRE message will appear at your Keypad and remain on until you silence the alarm (see below for silencing fire alarms).

*Temporal pulse sounding is produced for Fire alarms, as follows:

3 pulses—pause—3 pulses—pause—3 pulses—pause. . . , repeated.

TYPICAL FIRE EMERGENCY DISPLAYS



ALPHA DISPLAY KEYPAD



FIXED-WORD DISPLAY KEYPAD

Silencing Fire Alarms and Clearing Memory of Alarm

1. You can silence the alarm at any time by pressing the **OFF** key (the security code is not needed to silence fire alarms). To clear the display, enter your code and press the **OFF** key again (to clear Memory of Alarm).
2. If the Keypad's FIRE display does not clear after the second OFF sequence, smoke detectors may still be responding to smoke or heat producing objects in their vicinity. Investigate, and should this be the case, eliminate the source of heat or smoke.
3. If this does not remedy the problem, there may still be smoke in the detector. Clear it by fanning the detector for about 30 seconds. When the problem has been corrected, clear the display by entering your code and pressing the **OFF** key.

Smoke Detector Reset

Depending on the type of smoke detectors in your system, it may be necessary to "reset" the smoke detectors after a fire alarm has been turned off. Check with your installer. This "reset" is accomplished at a keypad, as follows:

Enter User Code (except "arm only" user), then press the [1] key.

Fire Alarm System (cont'd)

THIS SECTION APPLIES ONLY TO RESIDENTIAL SYSTEMS

Manually Initiating a Fire Alarm

1. Should you become aware of a fire emergency before your smoke or heat detectors sense the problem, go to your nearest keypad and manually initiate an alarm by pressing the panic key assigned for FIRE emergency for 2 seconds (see below). If a key pair has been assigned for fire, press both keys at the same time. See the *Using the Panic Keys* section below for further details.
2. Evacuate all occupants from the premises.
3. If flames and/or smoke are present, leave the premises and notify your local Fire Department immediately.
4. If no flames or smoke are apparent, investigate the cause of the alarm. The zone number(s) of the zone(s) in an alarm condition will be displayed at the keypad.

Using the Panic Key(s) Assigned for FIRE Emergency

A key or key pair may have been assigned for manually initiating a FIRE alarm. See the *Panic Keys* section for key assignments. For convenience, indicate the key or key pair assigned for fire below.

Individual Keys

A B C
☐ ☐ ☐

Press the individual key assigned for fire for 2 seconds.

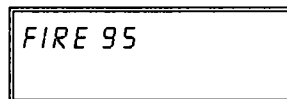
OR

Key Pairs

☐ ☐ 1 OFF and * READY
☐ ☐ * READY and #
☐ ☐ 3 STAY and #

Press both keys of the key pair assigned for fire at the same time.

DISPLAYS FOLLOWING MANUAL INITIATION OF A FIRE ALARM



ALPHA DISPLAY KEYPAD



FIXED-WORD KEYPAD

Fire Alarm System (cont'd)

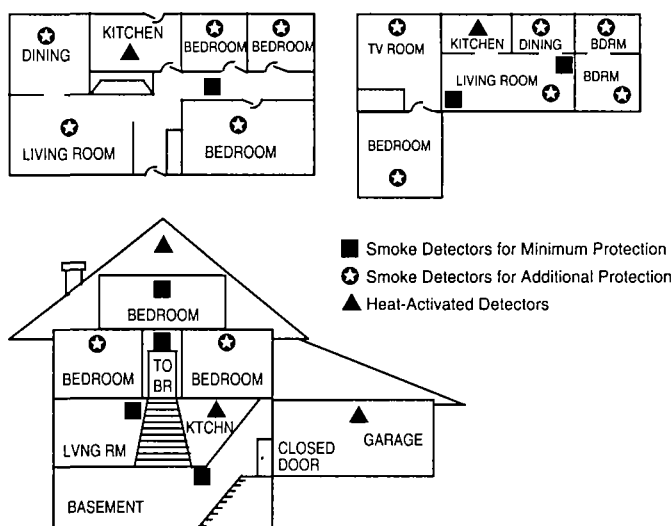
THIS SECTION APPLIES ONLY TO RESIDENTIAL SYSTEMS

National Fire Protection Association Recommendations on Smoke Detectors

With regard to the number and placement of smoke/heat detectors, we subscribe to the recommendations contained in the National Fire Protection Association's National Fire Alarm Code (NFPA 72) noted below.

Early warning fire detection is best achieved by the installation of fire detection equipment in all rooms and areas of the household as follows: A smoke detector installed outside of each separate sleeping area, in the immediate vicinity of the bedrooms and on each additional story of the family living unit, including basements and excluding crawl spaces and unfinished attics.

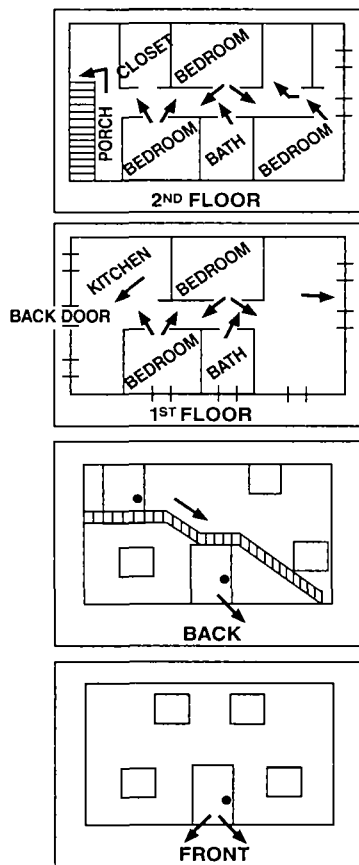
In addition, the NFPA recommends that you install heat or smoke detectors in the living room, dining room, bedroom(s), kitchen, hallway(s), attic, furnace room, utility and storage rooms, basements and attached garages.



Fire Alarm System (cont'd)

THIS SECTION APPLIES ONLY TO RESIDENTIAL SYSTEMS

Emergency Evacuation



Establish and regularly practice a plan of escape in the event of fire. The following steps are recommended by the National Fire Protection Association:

1. Position your detector or your interior and/or exterior sounders so that they can be heard by all occupants.
2. Determine two means of escape from each room. One path of escape should lead to the door that permits normal exit from the building. The other may be a window, should your path be impassable. Station an escape ladder at such windows if there is a long drop to the ground.
3. Sketch a floor plan of the building. Show windows, doors, stairs and rooftops that can be used to escape. Indicate escape routes for each room. Keep these routes free from obstruction and post copies of the escape routes in every room.
4. Assure that all bedroom doors are shut while you are asleep. This will prevent deadly smoke from entering while you escape.
5. Try the door. If the door is hot, check your alternate escape route. If the door is cool, open it cautiously. Be prepared to slam the door if smoke or heat rushes in.
6. When smoke is present, crawl on the ground. Do not walk upright, since smoke rises and may overcome you. Clearer air is near the floor.
7. Escape quickly; don't panic.
8. Establish a common meeting place outdoors, away from your house, where everyone can meet and then take steps to contact the authorities and account for those missing. Choose someone to assure that nobody returns to the house — many die going back.

Quick Guide to Basic System Functions

FUNCTION	PROCEDURE	COMMENTS
Check Zones	Press READY key.	View faulted zones when system not ready.
Arm System	Enter code. Press arming key desired: (AWAY, STAY, NIGHT-STAY, MAXIMUM, INSTANT)	Arms system in mode selected.
Quick Arm (if programmed)	Press #. Press arming key desired: (AWAY, STAY, MAXIMUM, INSTANT)	Arms system in mode selected, quickly and without use of a code.
Bypass Zone(s)	Enter code. Press BYPASS key. Enter zone number(s) to be bypassed (use 2-digit entries).	Bypassed zones are unprotected and will not cause an alarm if violated.
Quick Bypass (if programmed)	Enter code. Press BYPASS key + [#].	Bypasses all faulted zones automatically.
Silence Sounders Burglary: Fire: "Check":	Enter code. Press OFF key. Press OFF key. Press any key.	Also disarms system. Memory of alarm remains until cleared. Memory of Alarm remains until cleared. Determine cause.
Disarm System	Enter code. Press OFF key.	Also silences sounders. Memory of alarm remains until cleared.
Clear Alarm Memory	After disarming, enter code again. Press OFF key again.	Keypad beeps rapidly on entry if alarm has occurred while absent. Alarm display will remain upon disarming until cleared.
Duress (if active and connected to Central Station)	Arm or disarm "normally," but use your 4-digit Duress code to do so.	Performs desired action and sends silent alarm to Central Station.
Panic Alarms (as programmed)	Press key [A], [B], or [C] for at least 2 seconds, or key pairs 1 + *, * + #, or 3 + # respectively.	See the <i>Panic Keys</i> section for emergency functions programmed for your system. Note: Keys "A", "B", and "C" may have been programmed for other functions.
Chime Mode	<i>To turn ON or OFF:</i> Enter code. Press CHIME key.	The keypad will sound if doors or windows are violated while system is disarmed and chime mode is ON.
Test Mode	<i>To turn ON:</i> Enter code. Press TEST key. <i>To turn OFF:</i> Enter code. Press OFF key.	Tests alarm sounder and allows sensors to be tested.
Phone Access if applicable	Consult <i>Phone Access User's Guide</i> that accompanies the Phone Module.	Permits system access remotely, via Touch-tone phone.

Summary of Audible/Visual Notifications

Fixed-Word Display Keypads

SOUND	CAUSE	DISPLAY
LOUD, INTERRUPTED* Keypad & Ext.	FIRE ALARM	FIRE is displayed; zone number of zone in alarm is displayed. If a fire alarm is manually activated, zone number 95 will be displayed.
LOUD, CONTINUOUS* Keypad & Ext.	BURGLARY/AUDIBLE EMERGENCY ALARM	ALARM is displayed. Zone number of zone in alarm is also displayed.
ONE SHORT BEEP (not repeated) Keypad only	a. SYSTEM DISARM b. SYSTEM ARMING ATTEMPT WITH AN OPEN ZONE. c. BYPASS VERIFY	a. READY indicator light comes on. b. Number of the open protection zone displayed. c. Zone numbers of the bypassed protection zones are displayed (one beep is heard for each zone displayed). Subsequently, BYPASS is displayed.
ONE SHORT BEEP (once every 40 secs) Keypad only	a. SYSTEM IS IN TEST MODE b. LOW BATTERY AT A TRANSMITTER	a. Opened zone numbers will appear. b. BAT displayed with zone number of transmitter.
TWO SHORT BEEPS Keypad only	ARM AWAY or MAXIMUM	AWAY is displayed. Red ARMED indicator is lit.
THREE SHORT BEEPS Keypad only	a. ARM STAY, NIGHT-STAY, INSTANT b. ZONE OPENED WITH SYSTEM IN CHIME MODE.	a. STAY or INSTANT is displayed. Red ARMED indicator is lit. b. CHIME displayed; zone number of open protection zone will be displayed if the [*] key is pressed.
RAPID BEEPING Keypad only	a. TROUBLE b. MEMORY OF ALARM c. SYSTEM LOW BATTERY d. EXT. SOUNDER WIRING FAIL	a. CHECK displayed. Zone number of troubled protection zone is displayed. b. FIRE or ALARM is displayed; zone number of zone in alarm is displayed c. BAT displayed with no zone ID number. d. CHECK 70 is displayed.
SLOW BEEPING Keypad only	a. EXIT DELAY WARNING b. ENTRY DELAY WARNING	a. AWAY is displayed. b. Exceeding the entry delay time without disarming causes alarm.

* If a bell is used as external sounder, fire alarm is *pulsed ring*; burglary/audible emergency is *steady ring*.

Summary of A/V Notifications (cont'd)

Alpha Display Keypads

SOUND	CAUSE	DISPLAY
LOUD, INTERRUPTED* Keypad & Ext.	FIRE ALARM.	FIRE is displayed; descriptor of zone in alarm is displayed. If a fire alarm is manually activated, zone number 95 will be displayed.
LOUD, CONTINUOUS* Keypad & Ext.	BURGLARY/AUDIBLE EMERGENCY ALARM.	ALARM is displayed. If programmed, descriptor of zone in alarm is also displayed
ONE SHORT BEEP (not repeated) Keypad only	a. SYSTEM DISARM. b. SYSTEM ARMING ATTEMPT WITH AN OPEN ZONE c. BYPASS VERIFY.	a. DISARMED/READY TO ARM is displayed. b. Number and descriptor of open protection zone is displayed. c. Numbers and descriptors of the bypassed zones are displayed (One beep is heard for each zone displayed). Subsequently, the following is displayed: DISARMED BYPASS /Ready to Arm.
ONE SHORT BEEP (once every 40 seconds) Keypad only	a. SYSTEM IS IN TEST MODE. b. LOW BATTERY AT A TRANSMITTER.	a. Opened Zone identifications will appear. b. LO BAT displayed with description of transmitter.
TWO SHORT BEEPS Keypad only	ARM AWAY or MAXIMUM.	ARMED AWAY or MAXIMUM displayed. Red ARMED indicator lit.
THREE SHORT BEEPS Keypad only	a. ARM STAY, NIGHT- STAY, OR INSTANT. b. ZONE OPENED WHILE SYSTEM IS DISARMED.	a. ARMED STAY or ARMED INSTANT displayed. Red ARMED indicator lit. b. CHIME displayed, descriptor of open protection zone will be displayed if the [*] key is pressed.
RAPID BEEPING Keypad only	a. TROUBLE. b. MEMORY OF ALARM. c. SYSTEM LOW BATTERY. d. EXT. SOUNDER WIRE FAIL.	a. CHECK displayed. Descriptor of troubled protection zone is displayed. b. FIRE or ALARM is displayed; descriptor of zone in alarm is displayed. c. SYSTEM LO BAT displayed. d. BELL FAILURE is displayed.
SLOW BEEPING Keypad only	a. EXIT DELAY WARNING (if programmed). b. ENTRY DELAY WARNING.	a. ARMED AWAY or MAXIMUM is displayed along with You May Exit Now. b. DISARM SYSTEM OR ALARM WILL OCCUR is displayed. Exceeding the delay time without disarming causes an alarm.

* If a bell is used as external sounder, fire alarm is *pulsed ring*; burglary/audible emergency is *steady ring*.

Regulatory Statements and Warnings

WARNING: This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

RADIO FREQUENCY EMISSIONS

Federal Communications Commission (FCC) Part 15

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada

This Class B digital apparatus complies with Canadian ICES-003.
Cet Appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

TELEPHONE/MODEM INTERFACE

FCC Part 68

This equipment complies with Part 68 of the FCC rules. On the front cover of this equipment is a label that contains the FCC registration number and Ringer Equivalence Number (REN). You must provide this information to the telephone company when requested.

This equipment uses the following USOC jack: RJ31X

This equipment may not be used on telephone-company-provided coin service. Connection to party lines is subject to state tariffs. This equipment is hearing-aid compatible.

Industry Canada

NOTICE: The Industry Canada Label identifies certified equipment. This certification means that the equipment meets telecommunications network protective, operational and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves but should contact appropriate electric inspection authority, or electrician, as appropriate.

Ringer Equivalence Number Notice:

The **Ringer Equivalence Number (REN)** assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

Regulatory Statements (cont'd)

Industrie Canada

AVIS: l'étiquette d'Industrie Canada identifie le matériel homologué. Cette étiquette certifie que le matériel est conforme aux normes de protection, d'exploitation et de sécurité des réseaux de télécommunications, comme le prescrivent les documents concernant les exigences techniques relatives au matériel terminal. Le Ministère n'assure toutefois pas que le matériel fonctionnera à la satisfaction de l'utilisateur.

Avant d'installer ce matériel, l'utilisateur doit s'assurer qu'il est permis de le raccorder aux installations de l'entreprise locale de télécommunication. Le matériel doit également être installé en suivant une méthode acceptée du raccordement. L'abonné ne doit pas oublier qu'il est possible que la conformité aux conditions énoncées ci-dessus n'empêche pas la dégradation du service dans certaines situations.

Les réparations de matériel homologué doivent être coordonnées par un représentant désigné par le fournisseur. L'entreprise de télécommunications peut demander à l'utilisateur de débrancher un appareil à la suite de réparations ou de modifications effectuées par l'utilisateur ou à cause de mauvais fonctionnement.

Pour sa propre protection, l'utilisateur doit s'assurer que tous les fils de mise à la terre de la source d'énergie électrique, de lignes téléphoniques et des canalisations d'eau métalliques, s'il y en a, sont raccordés ensemble. Cette précaution est particulièrement importante dans les régions rurales.

Avertissement : L'utilisateur ne doit pas tenter de faire ces raccordements lui-même; il doit avoir recours à un service d'inspection des installations électriques, ou à un électricien, selon le cas.

AVIS : L'indice d'équivalence de la sonnerie (IES) assigné à chaque dispositif terminal indique le nombre maximal de terminaux qui peuvent être raccordés à une interface. La terminaison d'une interface téléphonique peut consister en une combinaison de quelques dispositifs, à la seule condition que la somme d'indices d'équivalence de la sonnerie de tous les dispositifs n'excède pas 5.

System Features Log

Features	Comments		
Exit Delay	Part. 1:	Part. 2*:	
Entry Delay 1	Part. 1:	Part. 2*:	
Entry Delay 2	Part. 1:	Part. 2*:	
NIGHT-STAY Zones	Zones:		
Quick Arm	yes	no	
Quick Bypass	yes	no	
Automatic Paging	yes	no	users:
Keyswitch Arming (circle type of LED lighting)	Arm AWAY:	steady	flash
	Arm STAY:	steady	flash

Function Keys	A	B	C	D	Comments
• Single-Button Arming					
• Step Arming					
• Paging (see Paging chart)					
• Time/Date Display					
• Macro Key 1					
• Macro Key 2					
• Macro Key 3*					
• Macro Key 4*					
• Emergency Key**: Personal					
• Emergency Key**: Silent Alarm					
• Emergency Key**: Audible Alarm					
• Emergency Key**: Fire					
• Device Activation					Device:

* Features marked with this single asterisk apply to the VISTA-20P/PS Series only.

** Emergency Keys: A = [1] / [*] B = [*] / [#] C = [3] / [#]

System Features Log (cont'd)

User Setup

The following chart will help keep track of system users. Copies should be distributed to the partition[†] 1 and partition[†] 2 (if applicable) masters for their records.

To program a user attribute:

Enter system/partition* master code + [8] + user no. + “#” command listed in column heading.

User No.	User Name	User's Part(s), [†] (system master only) [#] [3] + part(s) + [#]	Security Code enter new code	Auth. Level [#] [1] + level	Access Group [#] [2] + group	RF Zone Number [#] [4] + zone no.	Pager on/off [#] [5] + 0/1
01	installer	(all)		installer			(0)
02	system master	(all)		master			(0)
03	partition 1 master	(1)		(4)			(0)
04		(1)		(0)			(0)
05		(1)		(0)			(1)
06		(1)		(0)			(1)
07		(1)		(0)			(1)
08		(1)		(0)			(1)
09		(1)		(0)			(1)
10		(1)		(0)			(1)
11		(1)		(0)			(1)
12		(1)		(0)			(1)
13		(1)		(0)			(1)
14		(1)		(0)			(1)
15		(1)		(0)			(1)
16		(1)		(0)			(1)
17		(1)		(0)			(1)
18		(1)		(0)			(1)
19		(1)		(0)			(1)
20		(1)		(0)			(1)
21		(1)		(0)			(1)
22		(1)		(0)			(1)
23		(1)		(0)			(1)
24		(1)		(0)			(1)
25		(1)		(0)			(1)
26		(1)		(0)			(1)
27		(1)		(0)			(1)
28		(1)		(0)			(1)
29		(1)		(0)			(1)
30		(1)		(0)			(1)
31		(1)		(0)			(1)
32		(1)		(0)			(1)

* Partitions apply to the VISTA-20P/PS Series only.

System Features Log (cont'd)

User Setup (cont'd)

Enter system/partition master code + [8] + user no. + "#" command listed in column heading.

User No.*	User Name	User's Part(s). (system master only) [#] [3] + part(s) + [#]	Security Code enter new code	Auth. Level [#] [1] + level	Access Group [#] [2] + group	RF Zone Number [#] [4] + zone no.	Pager on/off [#] [5] + 0/1
33	partition 2 master	(2)		(4)			(1)
34		(2)		(0)			(1)
35		(2)		(0)			(1)
36		(2)		(0)			(1)
37		(2)		(0)			(1)
38		(2)		(0)			(1)
39		(2)		(0)			(1)
40		(2)		(0)			(1)
41		(2)		(0)			(1)
42		(2)		(0)			(1)
43		(2)		(0)			(1)
44		(2)		(0)			(1)
45		(2)		(0)			(1)
46		(2)		(0)			(1)
47		(2)		(0)			(1)
48		(2)		(0)			(1)
49		(2)		(0)			(1)

Authority Levels: 0 = standard user
 1 = arm only
 2 = guest
 3 = duress
 4 = partition master

Partitions: 0 = clears partition 1 and partition 2 defaults
 1 = partition 1 and common
 2 = partition 2 and common
 3 = common partition only

Paging: 0 = no paging
 1 = allow paging

* Users 34-49 apply to VISTA-20P/PS Series only; user 33 is partition 2 master for VISTA-20P/PS Series, and the last user for VISTA-15P Series.

Paging Setup

Pager	Pager Phone Number/ Prefix Characters	Automatically Reports Upon...						Sched.	Func. Key
		open/close		alarm/trouble		zone list			
		p1	p2	p1	p2	p1	p2		
1									
2									
3**									
4**									

** Pagers 3 and 4 and partitions apply to VISTA-20P/PS Series only.

System Features Log (cont'd)

Schedules*: master code + [#] + [6] [4]

No.	Event (see list below)	Device No. for "01" events: (see device list below)	Group No. for "02" events: enter 1-8	Partition** for "04-06" events: enter 1, 2, or 3	Start Time/ Day	Stop Time/ Day	Repeat (yes/no)	Random (yes/no)
01								
02								
03								
04								
05*								
06*								
07*								
08*								
09*								
10*								
11*								
12*								
13*								
14*								
15*								
16*								

Events: 00 = clear event 03 = latch key report 06 = auto disarm
 01 = device on/off 04 = forced STAY arm 07 = display "reminder"
 02 = user access 05 = forced AWAY arm

* VISTA-20P/PS Series can use schedules 01-16; VISTA-15P Series can only use schedules 01-04.)

** Partitions apply to the VISTA-20P/PS Series only.

List of Output Devices

Device**	Description	Schedule No.	Function Key
01			
02			
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			

(** VISTA-20P/PS Series can use devices 01-16; VISTA-15P Series can only use devices 01-08; both can use trigger devices 17/18.)

LIMITATIONS OF THIS SYSTEM

WARNING! THE LIMITATIONS OF THIS ALARM SYSTEM

While this system is an advanced design security system, it does not offer guaranteed protection against burglary or other emergency. Any alarm system, whether commercial or residential, is subject to compromise or failure to warn for a variety of reasons. For example:

- Intruders may gain access through unprotected openings or have the technical sophistication to bypass an alarm sensor or disconnect an alarm warning device.
- Intrusion detectors (e.g. passive infrared detectors), smoke detectors, and many other sensing devices will not work without power. Battery operated devices will not work without batteries, with dead batteries, or if the batteries are not put in properly. Devices powered solely by AC will not work if their AC power supply is cut off for any reason, however briefly.
- Signals sent by wireless transmitters may be blocked or reflected by metal before they reach the alarm receiver. Even if the signal path has been recently checked during a weekly test, blockage can occur if a metal object is moved into the path.
- A user may not be able to reach a panic or emergency button quickly enough.
- While smoke detectors have played a key role in reducing residential fire deaths in the United States, they may not activate or provide early warning for a variety of reasons in as many as 35% of all fires, according to data published by the Federal Emergency Management Agency. Some of the reasons smoke detectors used in conjunction with this System may not work are as follows. Smoke detectors may have been improperly installed and positioned. Smoke detectors may not sense fires that start where smoke cannot reach the detectors, such as in chimneys, in walls, or roofs, or on the other side of closed doors. Smoke detectors also may not sense a fire on another level of a residence or building. A second floor detector, for example, may not sense a first floor or basement fire. Moreover, smoke detectors have sensing limitations. No smoke detector can sense every kind of fire every time. In general, detectors may not always warn about fires caused by carelessness and safety hazards like smoking in bed, violent explosions, escaping gas, improper storage of flammable materials, overloaded electrical circuits, children playing with matches, or arson. Depending upon the nature of the fire and/or the locations of the smoke detectors, the detector, even if it operates as anticipated, may not provide sufficient warning to allow all occupants to escape in time to prevent injury or death.
- Passive Infrared Motion Detectors can only detect intrusion within the designed ranges as diagrammed in their installation manual. Passive Infrared Detectors do not provide volumetric area protection. They do create multiple beams of protection, and intrusion can only be detected in unobstructed areas covered by those beams. They cannot detect motion or intrusion that takes place behind walls, ceilings, floors, closed doors, glass partitions, glass doors, or windows.

Mechanical tampering, masking, painting or spraying of any material on the mirrors, windows or any part of the optical system can reduce their detection ability. Passive Infrared Detectors sense changes in temperature; however, as the ambient temperature of protected area approaches the temperature range of 90° to 105°F, the detection performance can decrease.
- Alarm warning devices such as sirens, bells or horns may not alert people or wake up sleepers if they are located on the other side of closed or partly open doors. If warning devices sound on a different level of the residence from the bedrooms, then they are less likely to waken or alert people inside the bedrooms. Even persons who are awake may not hear the warning if the alarm is muffled from a stereo, radio, air conditioner or other appliance, or by passing traffic. Finally, alarm warning devices, however loud, may not warn hearing-impaired people or waken deep sleepers.
- Telephone lines needed to transmit alarm signals from a premises to a central monitoring station may be out of service or temporarily out of service. Telephone lines are also subject to compromise by sophisticated intruders.
- Even if the system responds to the emergency as intended, however, occupants may have insufficient time to protect themselves from the emergency situation. In the case of a monitored alarm system, authorities may not respond appropriately.
- This equipment, like other electrical devices, is subject to component failure. Even though this equipment is designed to last as long as 10 years, the electronic components could fail at any time.

The most common cause of an alarm system not functioning when an intrusion or fire occurs is inadequate maintenance. This alarm system should be tested weekly to make sure all sensors and transmitters are working properly.

Installing an alarm system may make one eligible for lower insurance rates, but an alarm system is not a substitute for insurance. Homeowners, property owners and renters should continue to act prudently in protecting themselves and continue to insure their lives and property.

We continue to develop new and improved protection devices. Users of alarm systems owe it to themselves and their loved ones to learn about these developments.

WARRANTY

ADEMCO Limited Warranty

Alarm Device Manufacturing Company, a Division of Pittway Corporation, and its divisions, subsidiaries and affiliates ("Seller"), 165 Eileen Way, Syosset, New York 11791, warrants its product(s) to be in conformance with its own plans and specifications and to be free from defects in materials and workmanship under normal use and service for 24 months from the date stamp control on the product(s) or, for product(s) not having an ADEMCO date stamp, for 12 months from date of original purchase unless the installation instructions or catalog sets forth a shorter period, in which case the shorter period shall apply. Seller's obligation shall be limited to repairing or replacing, at its option, free of charge for materials or labor, any product(s) which is proved not in compliance with Seller's specifications or proves defective in materials or workmanship under normal use and service. Seller shall have no obligation under this Limited Warranty or otherwise if the product(s) is altered or improperly repaired or serviced by anyone other than ADEMCO factory service. For warranty service, return product(s) transportation prepaid, to ADEMCO Factory Service, 165 Eileen Way, Syosset, New York 11791.

THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. IN NO CASE SHALL SELLER BE LIABLE TO ANYONE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES FOR BREACH OF THIS OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, OR UPON ANY OTHER BASIS OF LIABILITY WHATSOEVER, EVEN IF THE LOSS OR DAMAGE IS CAUSED BY THE SELLER'S OWN NEGLIGENCE OR FAULT.

Seller does not represent that the product(s) it sells may not be compromised or circumvented; that the product(s) will prevent any personal injury or property loss by burglary, robbery, fire or otherwise; or that the product(s) will in all cases provide adequate warning or protection. Customer understands that a properly installed and maintained alarm system may only reduce the risk of a burglary, robbery, fire, or other events occurring without providing an alarm, but it is not insurance or a guarantee that such will not occur or that there will be no personal injury or property loss as a result. CONSEQUENTLY, SELLER SHALL HAVE NO LIABILITY FOR ANY PERSONAL INJURY, PROPERTY DAMAGE OR OTHER LOSS BASED ON A CLAIM THAT THE PRODUCT(S) FAILED TO GIVE WARNING. HOWEVER, IF SELLER IS HELD LIABLE, WHETHER DIRECTLY OR INDIRECTLY, FOR ANY LOSS OR DAMAGE ARISING UNDER THIS LIMITED WARRANTY OR OTHERWISE, REGARDLESS OF CAUSE OR ORIGIN, SELLER'S MAXIMUM LIABILITY SHALL NOT IN ANY CASE EXCEED THE PURCHASE PRICE OF THE PRODUCT(S), WHICH SHALL BE THE COMPLETE AND EXCLUSIVE REMEDY AGAINST SELLER.

This warranty replaces any previous warranties and is the only warranty made by Seller on this product(s). No increase or alteration, written or verbal, of the obligations of this Limited Warranty is authorized.

WIRELESS PHONE
SECURITY BACKUP

THE STICK™

HIGGINS INTERNATIONAL



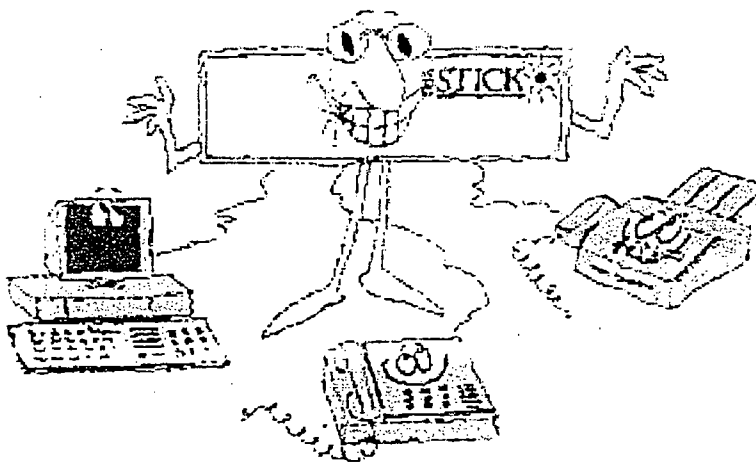
The Stick Manual

Call Toll Free:

Sales & Help: 866-337-0965

Tech Support: 800-535-4652

977-0234



FaxSwitch.com

1219

11 *3

11 *3

RELAX. This is NOT rocket science.

About This Manual

We are serious about making the finest products on the market. And we are serious about the information you need to make the product function correctly.... but we can't get real serious about writing product manuals.

There are enough bad product manuals out there to sink an aircraft carrier. You've probably seen them -the ones that take a degree in Electrical Engineering to figure out, or they are written in every language except English or... they are just plain boring.

Our humor or wit (or lack of either) in the rhetoric of this manual is not put here to lessen any aspect of the product except maybe the painful task of getting through some very dry material.

Thanks

Something you should know now that you have purchased our product-

You are the most important person in the world and we at Multi-Link want to THANK YOU for your business. We can't say it enough! At one time in America, business was conducted face to face where a word and a handshake were good enough.

While we seldom get the opportunity to personally meet and thank the people who buy our products, we realize your purchase of The Stick™ is a vote of confidence and trust in our product and our company. We will not betray this confidence or trust-that is our word and handshake to you.

You are the backbone of our business. The ultimate goal we, as a company, have targeted is your satisfaction. We want you as a customer and a commitment to your complete satisfaction AFTER THE SALE is our pledge.

If at any time you have a problem, comment or question
About The Stick™, its operation, functions or features call toll free:

- **Tech Support: (800) 535 4651**
- **Sales or Help: (866) 337-0965**

We want to hear from you. And again, THANKS for the opportunity to do business with you. You are important to us.

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Important Safety Instructions

When using your telephone equipment, basic safety precautions should always be followed to reduce the risk of fire, electric shock and injury to persons, including the following:

1. Read and understand all instructions.
2. Follow all warnings and instructions marked on the product.
3. Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
4. Do not use this product near water, for example, near a bathtub, washbowl, kitchen sink or laundry tub, in a wet basement, or near a swimming pool.
5. Do not place this product on an unstable cart, stand, or table. The product may fall causing serious damage to the product.
6. This product should never be placed near or over a radiator or heat register. This product should not be placed in a built-in installation unless proper ventilation is provided.
7. This product should be operated only from the type of power source indicated on the marking label. If you are not sure of the type of power supply to your home, consult your dealer or local power company.
8. Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.
9. Do not overload wall outlets and extension cords as this can result in the risk of fire or electric shock.
10. Never push objects of any kind into this product through slots in cabinet as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock. Never spill liquid of any kind on the product.
11. To reduce the risk of electric shock, do not disassemble this product, but take it to a qualified serviceman when some service or repair work is required. Opening or removing covers may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electric shock when the appliance is subsequently used.
12. Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
 - a. When the power supply cord or plug is damaged or frayed.
 - b. If liquid has been spilled into the product.
 - c. If the product has been exposed to rain or water.
 - d. If the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions because improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal operation.
 - e. If the product has been dropped or the cabinet has been damaged.
 - f. If the product exhibits a distinct change in performance.
13. Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.
14. Do not use the telephone to report a gas leak in the vicinity of the leak.

INSTALLATION INSTRUCTIONS

1. Never install telephone wiring during a lightning storm.
2. Never install telephone jacks in wet locations unless the jack is specially designed for wet locations.
3. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
4. Use caution when installing or modifying telephone lines.

"SAVE THESE INSTRUCTIONS!"

1. Introduction

Congratulations! You have purchased the highest quality voice/fax/modem call processor in the industry-The Stick! This manual has been designed to get you, your communications devices and The Stick operating on the phone line with a minimal amount of work.

Please read this manual carefully and **BE SURE TO FILL OUT AND MAIL YOUR WARRANTY CARD!**

How The Stick Works

When installed on a phone line, The Stick automatically answers all inbound calls and "screens" for one of three things.

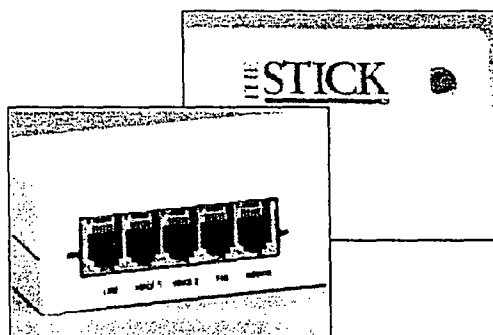
1. Fax tones (CNG - Calling tones)
2. Security Access Codes (in the form of DTMF/touch tones)
3. Nothing - No tones (normally voice calls)

While performing the "screening" function for fax tones, security access codes or the absence of tones, The Stick transmits phone company-simulated "ring back" tones to the calling party so they are "fooled" into thinking that the phone is ringing but what is really happening is The Stick is "listening" for these tones.

After the screening function is performed, the call is routed to the proper device leaving other phones/devices undisturbed over a single phone line.

Eliminating dedicated fax lines and incorporating the line sharing technology of The Stick adds up to giant savings.

Remote diagnostics and programming capabilities make it easy for our factory-trained technicians to make any programming changes right over the phone for you. Call 800-535-4651 if you need any assistance with installation or configuration of your Stick.



The Stick's performance is dependent on how it is installed on a home or business phone line and what programmable features are activated. The next section explains the different features, which optimize performance in particular installations.

Programmable Features

Read This First!!!!

- **Fax Tone Detection**-This feature, when activated, tells The Stick to detect the presence of CNG/fax tones which may be transmitted by a calling fax machine or PC Fax card.

All calls accompanied by CNG tones, whether they be from a fax machine or PC Fax card, are routed through to equipment connected to the device port labeled FAX.

If no fax-type equipment is used on The Stick, simply deactivate this feature.

Factory preset is "on".

- **Protected Hook Flash**-This feature allows The Stick to be compatible with certain multi-line KSU phone systems.

Some KSU systems do not allow touch tones (DTMF tones) to be generated from a telephone keypad after an inbound call has arrived.

With Protected Hook flash "on" the phone system can be "fooled" into generating touch-tones by striking the flash key. Calls can then be manually transferred between devices by dialing the proper security access code.

Factory preset is "off."

- **Unanswered Call Silent Transfer**-This feature was engineered for those of you who may receive manual fax or modem calls after normal business hours but do not use an answering machine.

Manual fax calls (not accompanied by CNG fax tones) and modem calls usually wind up routed to the phone when the caller cannot execute the proper access code.

With Unanswered Call Silent Transfer "on", the inbound call (routed to the phone) will be switched over to a designated port (see Silent Transfer Destination) after the unanswered phone has been rung the maximum number of rings.

Factory preset is "off."

Programmable Features Continued

- **Answering Machine Silent Transfer**-This feature is like Unanswered Call Silent Transfer except that it is designed for calls of 45 seconds or less.

It should only be activated when you are using an answering machine to field after-hours calls. When a manual fax or modem call arrives and the answering machine has answered, the caller will still be able to get to a destination device by staying on the line after the answering machine "times out".

If you answer a call and hang up before 45 seconds, The Stick will transfer the call to the designated device.

Factory preset is "off."

- **Silent Transfer Destination**-After activating either Silent Transfer feature, you will want to tell The Stick where to route the call.

The "Destination" program feature gives you the option of routing all after-hours calls to either the fax or modem.

Factory preset is to the port labeled "FAX".

- **Programmable Security Access Codes (SAC's)**-Transfer of a call is executed by dialing the programmed SAC for each voice/data device connected to The Stick.

SAC's are programmable (using a touch tone phone only) up to 4 characters long-digits 0 through 9 and symbols * Touch Tone Pulse Dial (star) and # (pound). The Stick will not detect SAC's dialed from "calling" pulse phones-only from touch-tone phones.

Call transfers dialed by a pulse phone are limited to phones hooked to or on the same line as The Stick and are limited to transfer to the "FAX" port only.

The pulse dial SAC for this is fixed at "2" You must also have the "**Pulse Select**" feature on if you use a pulse dial phone to transfer a call.

- **Pulse Detection**-The Pulse Detection feature, when activated, allows The Stick to detect the factory-preset code "2" and "Call Grab" preset code "9" when dialed from a pulse dial phone.

The factory preset for this feature is "off."

Programmable Features Continued

- **Rings To Answer**-This feature directs The Stick to answer an inbound call after a programmed number of phone company rings (0 to 10 rings).

If RTA is programmed to "0", The Stick will answer the call during the first ring. Extension phones elsewhere in your location will only "chirp" the first ring before going quiet. If the RTA is greater than "0", The Stick will allow all incoming calls to ring extensions and devices connected to the ports labeled VOICE 1 and VOICE 2 for the programmed number of rings.

Factory preset is 0 rings.

- **Call Override**- With Call Override "on"-when The Stick "answers" a call and you pick up an extension more than one second later, The Stick will recognize the lifting of the handset and stop transmitting ring back tone to the caller. You can immediately begin to talk or (within 15 seconds) transfer the call to another device.

In some areas of the country, your local telephone company's lines and switching equipment may cause this feature to not function properly. Just deactivate the feature. (See the "Call Grab" feature explanation in the Standard Features section for another option to Call Override.)

Factory preset is "off."

- **Maximum Rings**-This feature allows you to program the number of rings transmitted to your phones/answering machine, fax and modem by The Stick. Maximum Rings can be programmed anywhere from 4 rings (minimum) to up to 30 rings.

Factory preset is 8 rings to all equipment.

- **Unrestricted Manual Transfer**- With the UMT feature "off," The Stick will only allow a manual transfer to be done during the first 15 seconds of an inbound call when answered from an extension.

The UMT feature, when activated, enables a transfer to be executed from an extension phone and by either party at any time during the call, no matter if the call is inbound or outbound.

Of course, inbound calls answered by equipment through the VOICE 1 or 2 ports may be transferred at any time using the appropriate SAC, regardless of the setting for this feature.

Factory preset is "on."

Standard Features

- No Programming Needed!

- **Barge-In Protection-** When installed on an incoming telephone line before ALL telephone equipment (extension wall jacks or multi-line phone systems), The Stick will protect any voice or data call from being accessed by other telephone equipment on the same line. Any phone device that goes "off-hook" during a conversation or data transmission will receive a silent line.

Note: The Barge-In Protection feature will control only those phone/data devices connected directly to The Stick. For optimum performance and protection, it is recommended that all premise extension phones be wired into The Stick at either the Voice 1 or Voice 2 ports. Relax! This is not a difficult operation to perform.

See the section titled "Installation Procedures" for the easiest way to get the job done.

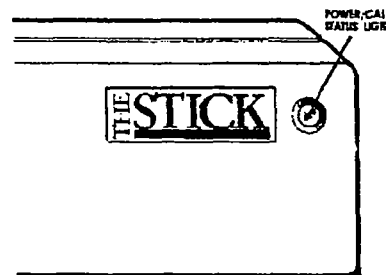
- **Call Grab-** If the Call Override feature does not perform due to any line problems with your local phone service provider, this standard feature will allow you to override The Stick's tone detect and call routing operation.

Call Grab can be initiated from any touch-tone or pulse extension phone by dialing "9" on the telephone keypad. When "9" is dialed, The Stick will immediately cease its call routing function. This feature is standard and will work regardless of the status of the "Call Override" feature.

Note: YOU must enable the "Pulse Detect" feature if you want to grab a call from a pulse dial phone.

- **Power/Call Status Light-** The LED on the front of The Stick demonstrates two functions-when lit, it tells you the unit is powered up and while processing inbound and outbound calls, the LED signals which port is being used.

A "one blink" pattern tells you a voice call is being processed, a repeating "two blink" pattern says The Stick has either detected CNG tones and is routing the call to your fax machine or a fax is outbound.



A repeating "three blink" pattern denotes the proper security access code has been monitored and a caller has been monitored and a caller has been routed to your computer modem or data is being transmitted outbound from your computer modem.

The "How To" of Programming

Programming The Stick

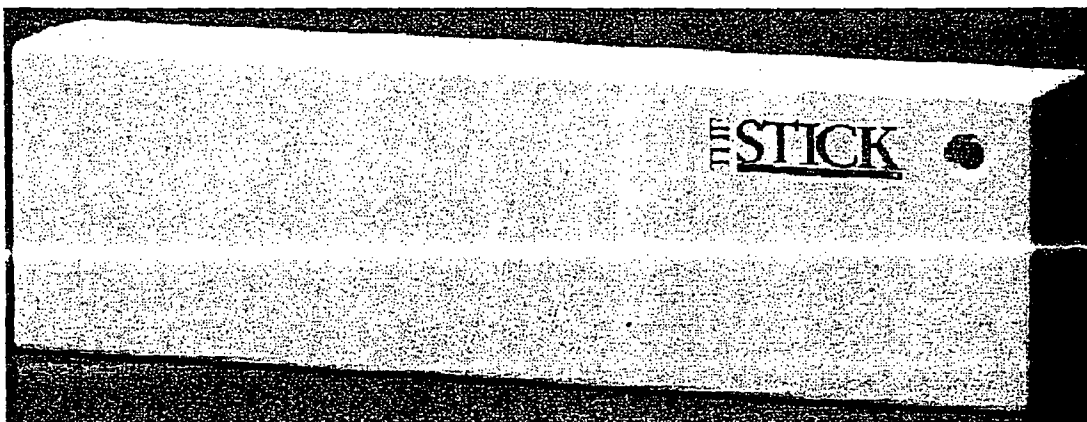
The average consumer usually starts to freak when they open up any product manual and see the word "PROGRAMMING". We have all experienced "programming" anxiety with VCR's, computers, fax machines. . . .whatever. Relax. This is relatively painless.

All you have to do is understand each programmable feature and how you want The Stick to operate in your chosen installation.

On the next page is the Programming and Quick Reference Guide. This table was developed as an easy reference/record for program features with corresponding Register Number, programming range of each feature, the factory preset of each feature (how The Stick works "out of the box" if you don't bother to program anything), program recommendations for certain types of installations and finally, a space for writing down what you've done (or what you want The Stick to do).

Please use the Programming and Quick Reference Guide. Mark on it. Highlight it. If you can't remember which Register Number controls which feature. . . .refer back to it. And take a tip from us, pencil in how you have programmed all the features. It will save you some time and frustration.

We advise you to read through the Programmable Features section again if you are not quite sure of how you want The Stick to operate.



Tones / Programming Commands

THE STICK PROGRAMMING AND QUICK REFERENCE GUIDE

Register Number	Programmable Feature	Program Range	Factory Preset	Programming and Installation Recommendations	Your Program
	FAX Tone Detection	0 = off 1 = on	ON	Regardless of how you install the Stick, if a FAX/PC Fax Card is used- Program this feature "ON"	
	Protected Hook Flash	0 = off 1 = on	OFF	With older KEY and PBX systems, you may need to program this feature "ON"	
	Unanswered Call Silent Transfer	0 = off 1 = on	OFF	"UCST" routes all unanswered after-hours calls to fax or modem ports (on any installation) - program "ON"	
	Silent Transfer Destination	0 = fax 1 = modem	FAX	This feature determines what device will receive a call after it has been "silently transferred"	
	Pulse Detection	0 = off 1 = on	OFF	If you have pulse-dial phones and wish to transfer or "grab" a call- program this feature "ON"	
	Call Override	0 = off 1 = on	OFF	If The Stick is installed at a wall jack and you want to answer a call from any extension phone - program "ON"	

	Unrestricted Manual Transfer	0 = off 1 = on	ON	Gives transfer ability at any time, from either party from any phone, recommended programming "ON"	
	Answering Machine Silent Transfer	0 = off 1 = on	ON	After answering machine times out, call will be routed to fax or modem port (any installation) - program "ON"	
	Security Access Code for VOICE Ports	Digits 0-9 * and # 4 digits max.	*1	This register contains the code for transfer of a voice or modem call to devices connected to voice 1 & 2 ports	
	Security Access code for FAX Port	Digits 0-9 * and # 4 digits max.	*2	This register contains the code for transfer of a voice or modem call to FAX / PC Fax Card CONNECTED to fax port	
	Security access code for MODEM Port	Digits 0-9 * and # 4 digits max.	*3	This code is usually sent by calling modem - we recommend programming a 4 digit code for security purposes	
	Rings to answer	0 to 10 Rings	0 Rings	If The Stick is used on a KSU or PBX set to "0" - home installs w/ext. phone access, program needed no. of rings	
	Maximum rings	4-30 Rings	8 Rings	This feature controls the number of times a device (voice, fax, modem) is rung by the stick before dropping the call	

Initial Check

Included with The Stick are additional items that make life a whole lot easier. Please check the box and make sure you have:

- The Stick™ Voice/Fax/Modem Call Processor
- One 12 Volt Class 2 Power Source
- One Silver Modular Line Cord

If any of these items are missing, please alert the Sales Department toll free at 866-337-0965 and also Technical Support at 800-535-4651



POWER UP

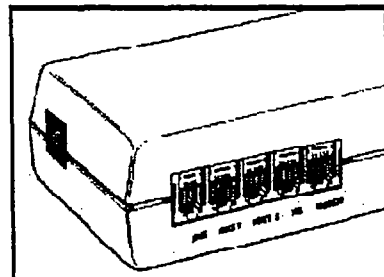
The first thing you must do before programming The Stick is to "power up" the unit. It is recommended that you choose a power outlet close to a telephone wall jack. Plug the power supply (supplied) into the 110 volt outlet and insert the barrel plug into the port labeled:

USE ONLY WITH
12 VAC 0.8-1.0A
CLASS 2
POWER SOURCE

At the rear of the unit. The red light beside "The Stick" logo should be lit at this time.

CONNECTING TO THE PHONE LINE

Before programming The Stick, you will need to install it on your existing telephone line and connect a touch-tone (DTMF) telephone to the port labeled "VOICE 1" at the bottom of the unit.



A silver Modular Line Cord has been supplied for connecting The Stick to a phone line. Plug one end of the line cord into the port labeled "LINE". Plug the other end into a telephone wall jack. At this time you should hear dial tone when the handset on your touch-tone phone is lifted off-hook.

Overview of Programming

The "How To" of Programming

Now that you've gotten everything hooked up and in place, the fun begins! We advise that you read through this section once or twice for familiarity with the process. You may also want to refer back to the Programming and Quick Reference Guide table to pencil in selected programming values for each feature you wish to control.

The first thing you should do is to place a local call to your best buddy. Ask him or her to lay their phone receiver down for a moment.... but don't hang it up. This will keep you from incurring any long distance phone charges or "freaking out" the local phone company with all the numbers you will dial to program The Stick.

After placing a call to your friend, wait at least five seconds before proceeding. First, DIAL "# # 7 7" on your telephone keypad. The LED light will begin blinking rapidly. Immediately listen for three rapid high - pitch beeps in your handset. Three high-pitched tones indicate that you have entered the programming mode and may "PROCEED".

At this time, you should enter the Register Number of the feature you wish to program and proper value(s). If the proper register number and programming value(s) are entered, The Stick will answer with a high-pitch tone immediately followed by a mid-pitch tone. It kind of sounds like "bee-blip". This means "OK".

If the numbers you enter are invalid (either for the Feature Register or program value), The Stick will respond with a single low-pitch "ERROR" tone. This tone might remind you of the sound you hear when you "blow it" on your favorite video game.

In either case, three rapid high-pitch tones will immediately follow telling you to "PROCEED". At this time you may either access and program a new feature register or correct the previous attempt by entering new numbers.

Summary of the types of tones you will hear.

"PROCEED"-Three high-pitch tones in rapid succession tell you The Stick is ready to program a register or receive more commands in the form of touch tones. "Bee-Bee-Beep"

"OK"- (or "Okay" for you purists)-One high-pitch tone immediately followed by a mid-pitch tone means that the numbers that you have entered are acceptable and within range for the Register Number and feature value. "Bee-Bip"

"ERROR"- A single low-pitch tone indicates that the Register Number, feature value or program commands (we talk about those next) you have entered are invalid. Common errors committed when programming could be:

- Entering the Register Number for a feature, let's say it's "Protected Hook Flash", and you enter only part of the number. The Register Number for "Protected Hook Flash" is "02". If you enter "2" The Stick will give you an "ERROR" tone.
- Entering a feature value that is outside of the program range. As an example, we will use "Protected Hook Flash" again. You are only allowed to program this feature value as "0" (off) or "1" (on). If you enter the number "2" after the correct Register Number, The Stick will give you an "ERROR" tone.

Programming Commands

Save To Memory/Exit- After programming all feature values you wish to manipulate, you will need to save the program to memory and exit the programming mode. This can be done by dialing "80". At that time you will hear the "OK" tone twice. The LED will go back to normal operation. Even if there is a power loss to The Stick, all programming is saved.

No Save/Exit- If you wish to "dump" any programming you've done and exit the programming mode, dial "90" At that time you will only hear the "OK" tone once. The LED will go back to normal operation.

Set Registers To Factory Preset- This command sets all program registers to the factory presets (refer to the Programming and Quick Reference Guide). When you dial "60" all registers automatically revert to factory preset. The Stick will answer with an "OK" tone followed immediately by a "PROCEED" tone. Dial "80" to save and exit.

A quick review of Programming

This is "the big picture" for how to program The Stick.

Being the good consumer you are, you've read the manual thoroughly (NOT!), penciling in the feature changes on your Programming and Quick Reference Guide. You call your mom (a local call) and ask her to lay the phone down for a moment while you program this neat new call processor you've just purchased. She says OK.

You've decided to reprogram the Security Access Code for the MODEM port, turn the "Unrestricted Manual Transfer" feature off and turn the "Pulse Detect" feature on.

Programming Commands continued

1. Since five seconds has more than elapsed since you initiated the your mom, you can enter the programming mode. You dial "##77" on your touch-tone phone connected to the "VOICE 1" port.

The Stick Response: Answers with a "PROCEED" tone. The LED is blinking very rapidly. You have 30 seconds to begin the next command.

2. You change the SAC for the MODEM port to "007" by dialing "13" selects Register 13 (Security Access Code for MODEM port) and 007 is the new SAC.

The Stick Response: Answers with an "OK" tone, then a "PROCEED" tone. You have 30 seconds to begin the next command.

3. You change the "Unrestricted Manual Transfer" feature to "OFF" (factory preset "ON") by dialing 070. "07" selects Register 7 and "0" turns the feature off.

The Stick Response: Answers with an "OK" tone, then a "PROCEED" tone. You have 30 seconds to begin the next command.

4. You change the "Pulse Detect" feature to "ON" (factory preset "OFF") by dialing 051. "05" selects Register 5 and "1" turns the feature on.

The Stick Response: Answers with an "OK" tone, then a "PROCEED" tone. You have 30 seconds to begin the next command.

5. You have finished programming the desired feature changes and wish to save them to nonvolatile memory and exit the programming mode. You dial "80".

The Stick Response: Answers with the "OK" tone twice. The LED returns to normal blinking which demonstrates that your touch-tone phone connected to the "VOICE 1" port is off-hook.

Check and see if your mom is on the other end of the line.
If not, hang up the phone.

NOTE: If The Stick does not receive a command within 30 seconds, it will give you an "OK" tone and exit the programming mode without saving any programming. Basically it is acting as if you have dialed "90".

(See section titled Programming Commands.)

Audible "Read Back" of Programming

PROGRAMMING-BEEP BEEP BEEP-BOOOOOOOP!

There is a programming command that allows The Stick to audibly "read back" (via the phone) the values of any program register.

This feature is handy when you forget what you have just programmed and want a quick read back or checking to see if a feature is (de)activated before leaving your home or office.

There are two types of tones that The Stick will transmit through your receiver on the audible "read -back":

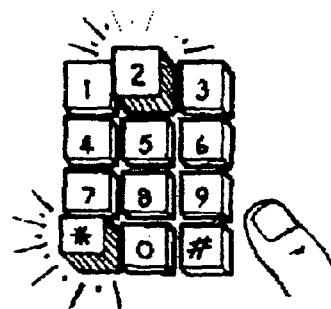
- A clipped, high-pitched "bip" which has a numerical value of one.
- A long low-pitched "beep" which has the numerical value of five.

The chart below describes the audible tones, which coincide with each number or symbol in a register.

Number / Symbol	Audible Tones
1	"BIP"
2	"BIP BIP"
3	"BIP BIP BIP"
4	"BIP BIP BIP BIP"
5	"BEEP"
6	"BEEP BIP"
7	"BEEP BIP BIP"
8	"BEEP BIP BIP BIP"
9	"BEEP BIP BIP BIP BIP"
0	"BEEP BEEP"
*	"BEEP BEEP BIP"
#	"BEEP BEEP BIP BIP"

Executing Audible "Read Back" With The Stick:

First, you must enter the programming mode by dialing "# #3 7 7". Then press "*" and the Register Number you wish to read back.



Audible "Read Back" of Programming continued

An example:

- First, you press "# # 7 7" on your touch-tone phone to enter the programming mode.
- The Stick responds with a "PROCEED" tone.
- You press "* 0 5"
(telling The Stick to audibly read back the value in Register 5).
- The Stick transmits 2 'Beeps' signifying the value "0"
(the feature is turned off).
- After a short pause, The Stick will transmit an "OK" tone followed by a "PROCEED" tone.
- At that time you may either "read back" or program any register.

For Registers Containing More Than A Single Value

Some registers can (or are required to) contain more than a single value, i.e., Registers 11 to 15. Here's a short example of what a "read back" would sound like where more than 2 digits or symbols are programmed in the register.

Let's say the register you want to "read back" is number 13, the Security Access Code for the MODEM port, and it is programmed as "* 7 5":

- You first enter programming (# # 7 7).
- Press "* 1 3" to "read back" Register 13.
- The Stick transmits "Beep Beep Bip (pause) Beep Bip Bip (pause) Beep".
(Equivalent to * 7 5).

Stick immediately transmits the "OK" and "PROCEED" tones.

Note: You will receive an "Error" tone when entering an incorrect Register Number on audible "read back". Never fear-try again!

Pointers for hook-up of voice/data equipment

Voice / Data Equipment

This section involves the connection of communications equipment to The Stick. You may configure the "hook up" of different types equipment in a number of ways. Whatever suits your operational needs and your installation requirements!

Although each device port is labeled with generic titles designating what equipment would connect to what port, **YOU CAN CONFIGURE IT ANY WAY YOU LIKE!** Just be sure to read this section thoroughly before trying anything weird (that might not work).

FAX / PC Fax Cards

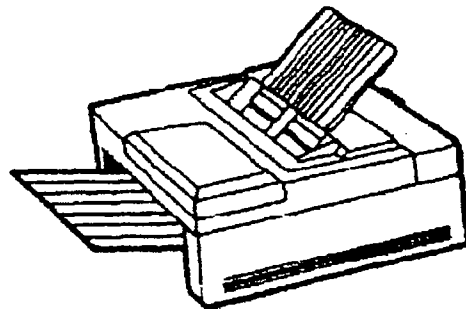
The Stick has special features that make it work extremely well with either a PC FAX Card or a FAX machine. The feature that enables The Stick to route an incoming FAX call to your "FAX" type device is "FAX Tone Detection".

What's a "FAX Tone"?

In a nutshell, most FAX machines generate a tone when they are operated "automatically". Automatic generally means you just drop the paper(s) to be faxed in the document carriage, the machine loads it, the desired phone number is entered, you hit the "START" button and you're done.

The machine automatically dials the number and begins emitting the tone (commonly known as CNG or AUTO-FAX tone) to identify itself as a FAX-type device.

This tone is continuously transmitted until the called FAX machine answers the call and "handshakes" with the sending FAX.



With The Stick at the receiving end, the call is "answered" and the FAX Tone is detected. At that time the call is routed to the port labeled "FAX". Hence, we suggest if you use either a FAX machine or PC FAX Card connect it to the port labeled "FAX".

From The "..... And Here's Another Curve Ball" File.

Sometimes people pick up the handset on their FAX machine and dial the phone number of the fax machine they want to connect with. By doing this they have told their FAX machine they want to use it for voice purposes only.

No problem for the FAX machine.....but now it will transmit any AUTO-FAX tones after dialing a phone number. If The Stick is at the receiving end, it will answer the call and detect the absence of FAX tones, assume it is a voice call and route it to the VOICE 1 & 2 ports.

When you answer the phone, the person at the other end will say, "I am trying to send you a FAX!" Of course you can manually transfer the call to your FAX by pressing *2 (or another code if reprogrammed).

But before you do, we suggest you share the nugget of brilliant information found in the preceding paragraph with your misguided (no pun intended) caller and suggest the next time they fax you, try calling without lifting the FAX machine handset. It will make everything a whole lot easier at both ends of the conversation.

PC FAX Cards And The Meaning of Life...

If a PC FAX Card is connected to The Stick at the port labeled "FAX", you should have no operational problems when a call is routed. There are about a half-a-million different types of PC FAX Cards on the market today and each has its own operational idiosyncrasies.

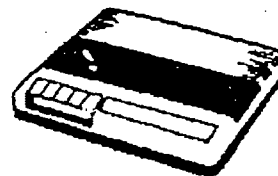
If you do experience a problem, check the operations manual included with the PC FAX Card. If you can't figure the problem out on your own - call our Tech Support gurus at 1-800-535-4651, they're pretty sharp about stuff like that.

Answering Machines

An answering machine is an effective tool when used with The Stick. When connected to either "VOICE" port, the answering machine will field any unanswered voice calls, and via a message, provide instructions on how to access other equipment.

A sample message might go something like this:

Hi! You have reached (Name/Company/Phone Number). We are not in right now, but if you wish to leave a message, wait for the beep.



If you want to send us a FAX, press * 2 (or reprogrammed code). If you can't dial * 2 on your phone, just stay silent after the beep and wait until the answering machine stops.

You will then be transferred to the FAX automatically. Start transmission when you hear our FAX signal. Thanks and have a nice day!

This message reflects the use of three programmable features-the SAC for the FAX port, Answering Machine Silent Transfer and Silent Transfer Destination. The SAC for transfer to the FAX machine is factory preset at *2 "Answering Machine Silent Transfer" has been programmed "on" and the "Silent Transfer Destination" used is factory preset to the "FAX" port.

Retrieving An Answering Machine Message- Most answering machines on the market today have factory preset "retrieval codes" for accessing a message from a remote phone. There is no special feature on The Stick for accessing your answering machine: just call your phone number, let the machine answer the line, and dial your "retrieval code".

Again, we remind you to program all SAC's used for voice/data equipment differently from your answering machine "retrieval code".

Computer Modems

The Stick is compatible with all dial-up modems that use a "single pair" RJ-11 line cord to connect to a phone line. We suggest connecting the modem to the port labeled "MODEM" (we bet you've already figured that one out!). Most incoming calls to your modem are from remote (off location) computer modems. The Stick will route calls to your computer modem when the calling modem dials the proper SAC after The Stick has answered the call.

The "How To" Of Calling Your Modem- For any person to access your modem through The Stick, they must know your programmed Security Access Code for the "MODEM" port. Dialing your telephone number and SAC is done on the remote computer communications software. It should look something like this (for a HAYES-compatible modem):



ATDT 1606 555 1234,,*3

The commas after the phone number are commands telling the modem to wait two seconds per comma before dialing the SAC ** 3. You should instruct your friends to "time" a call to your residence. Tell them to count the seconds between the last digit dialed and the last ring to the phone before The Stick answers the call (how many rings before The Stick answers). Divide that amount of seconds by two and you have the needed number of commas between the phone number and SAC.

It is safe to repeat the SAC twice in the dialing string like so:

ATDT 1 606 555 1234,,*3,,*3

Note that additional commas will need to be inserted between the SACs at the end of the dialing string. A minimum of 2 seconds between SACs is needed for The Stick to recognize and register the proper sequence of digits and symbols.

Some modems cannot dial the * and # symbols. You may want reprogram a specific code for one time access by an outside caller.

Again, if you have any questions, call our Tech Support line at 1-800-535-4651. Our factory-trained technicians can help you out on timing or SACS.

Other Stuff That Works

The Stick can operate on virtually all multi-line Key and PBX phone systems. We do recommend a specific type of installation for The Stick on either system. Refer to the section on Installation.

The Stick is also compatible with virtually all Credit Card Authorization Terminals, Point of Sale Terminals, Loop-Start dial-up TELEX machines, dictation machines, Answering Machines, cordless telephones, CALLER ID Display equipment-anything that requires a phone line to communicate.

If you have a CALLER ID Display device, we do recommend that it be installed on the telephone line BEFORE The Stick and the "Rings To Answer" feature be set for 2 or more rings. The data transmitted by the local Telco, which identifies the calling party's phone number, arrives between the first and second ring so it should register on the display device without a problem.

Services Offered by Your Local Telco- Most telephone companies are now marketing "Call Packages" that allow subscribers to customize their phone service in a multitude of ways. Most of the different services available are compatible with The Stick, but some may impede performance. Here are a few:

- **Call Waiting-**The "beep" heard during a phone conversation, alerting you of another call, will not affect the performance of The Stick. However, pressing the hook switch to field a call will cause The Stick to do strange things....like inadvertently transferring a call to your fax machine. We do not advise having call waiting on the same line with The Stick.
- **Call Forwarding-**The Stick's automatic answering function (answer after a programmed number of rings) will not allow calls to be forwarded to another phone number. You may want to weigh the pros and cons of using The Stick versus the Call Forwarding service.

Installation

Introduction

This next section covers installation for The Stick in various configurations and applications. We have tried to cover virtually all installation, scenarios that may be found in the home and business. If we missed yours or you have something weird in mind for an installation - please call. Maybe we can help you out or save you some time and unneeded expense.

Where You Gonna Put It?

It really makes no difference if you are installing The Stick in a business or a home-the main considerations for installation really have to do with how you require The Stick to perform and what you are willing to do with it as far as installation requirements go. Below are the three main questions you should ask yourself:

1. **Do You Require "Barge-In" Protection or Call Access From All Extensions?**
2. **Is There A Multi-line Phone System Present?**
3. **How Much Hassle and Expense Do I Want To Incur Installing The Stick?**

How Do You Want It To Work?

To better understand the type of installation/placement that may be right for you, think of The Stick as either a "traffic cop" or a "personal secretary".

!@&?)+!! Traffic Cops!

"Traffic cops" aren't the most popular people in the world so we'll keep this analogy short and sweet. If installed into the phone-line BEFORE all phone extensions, wall jacks, multi-line phone systems, etc., The Stick acts like a "traffic cop" at an intersection. All inbound call "traffic" is intercepted by The Stick via its automatic answer feature and routed to its proper destination (i.e. phone, fax, modem).

The standard feature that makes this type of installation attractive is "Barge-In Protection" and The Stick's ability to transfer a call between devices. If a voice call is answered and routed, only the phones will ring. If a call, accompanied by CNG, is answered and routed, only the fax machine will receive the call. Once a call is directed to its intended device, our "traffic cop" also keeps equipment connected to The Stick from "Barging-In" on the existing call.

Once again, for The Stick to perform in this manner, it must be installed on the phone line BEFORE all phone extensions, wall jacks or phone systems.

Your Own Personal Secretary

Everybody needs their own personal secretary to screen calls when they are busy with other things. If you install The Stick on the phone line by plugging it into a telephone wall jack, that is basically what you've got-somebody to answer an incoming call and either:

- A. Tell you it is a voice call (by ringing the phone connected to a VOICE port) or
- B. Route it to the appropriate equipment

Here's the scenario-you are in the basement working one Saturday and the phone rings. Of course you have 3 or 4 extension phones scattered about your palatial estate, and particularly, one in the basement.

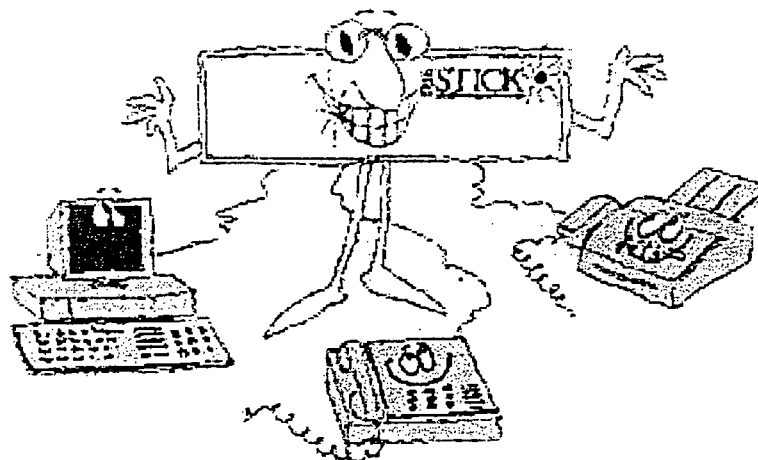
With The Stick plugged into a telephone wall jack upstairs, you have the option of either "grabbing" the call before The Stick does via the basement extension or allowing The Stick to answer the call and route it to the appropriate device.

This type of installation gives you the advantage of accessing an inbound call from any extension- but you lose "Barge-In Protection". Manual transfers can still be executed from an extension phone if needed.

The Right Features For The Right Installation

In the next section, we have outlined different types of installations and included some recommendations for feature settings that should optimize performance of The Stick for that particular installation.

These are just recommendations. If you don't like the way it works-mutter something under your breath about "busybodies" and change feature settings. We don't mind.



On Single Phone Line

INSTALLING THE STICK ON A SINGLE PHONE LINE

Single line installation is pretty much a no-brainer. If this is how your home or office is wired, then you should browse through each wiring configuration to find out the best one for your needs.

SIMPLE PLUG-IN (ONE WALL JACK, NO EXTENSIONS)

Pros:

- Great Barge-In Protection!
- Easy Installation!

Cons:

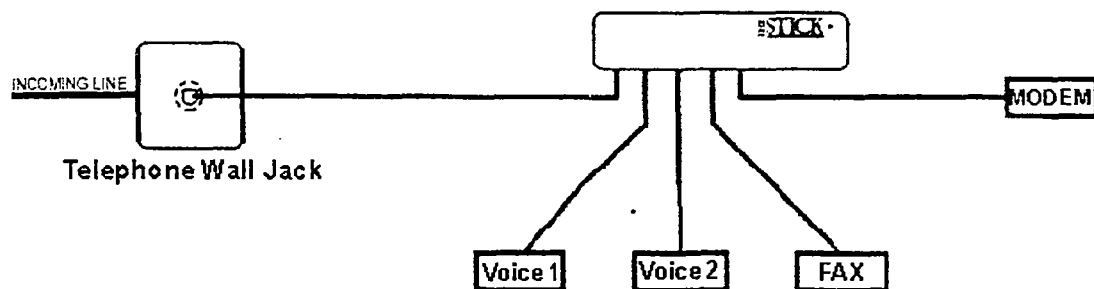
- Fat Chance You'll Be Lucky Enough To Have This Wiring Configuration

Installation:

- Simply unplug whatever is in the wall jack and connect the "LINE" input of The Stick to the wall jack with the supplied line cord.
- Reattach your phone to the VOICE 1 port and connect your answering machine and data equipment to their respective ports.

Feature Recommendations Pertinent To This Installation:

- Rings To Answer - Set To "0". The Stick will answer the call immediately.
- If You Have A Pulse Dial Phone, Set Pulse Detection ON.



SIMPLE PLUG-IN WITH MULTIPLE EXTENSIONS

Pros:

- Can Access Calls From Extension Phones!
- Easy Installation!
- Installation Can Occur At Any Wall Jack.

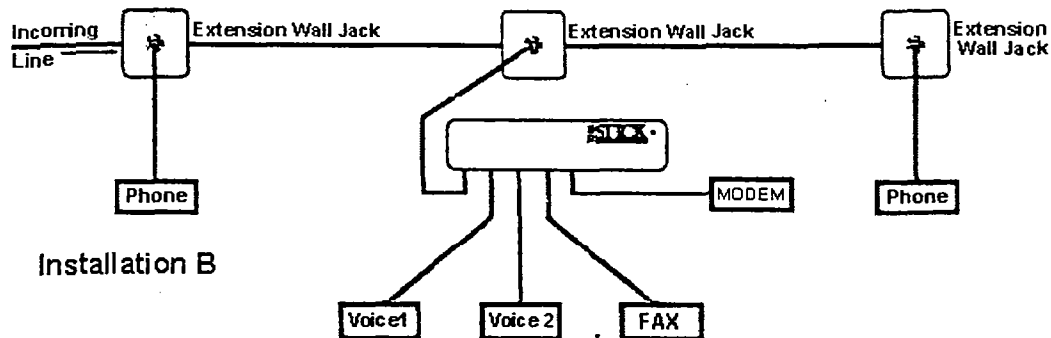
Cons:

- No Barge-In Protection-Sorry!

Note: This installation is the same as the "Simple Plug-In, No Extensions". Connection to a telephone wall jack is the same.

Feature Recommendations Pertinent To This Installation

- If any phones are pulse dial, program Pulse Detect ON.
- If you wish to access a call from an extension phone prior to The Sticks answering, program the needed amount of rings in the "Rings To Answer" feature.
- Program "Call Override" to ON for call access AFTER The Stick has answered a call.



SIMPLE PLUG-IN WITH EXTENSIONS AND TOTAL BARGE-IN PROTECTION

Pros:

- Provides Total Barge-In Protection.
- Only voice calls will ring phone extensions.
- The best installation for total control of inbound calls.

Cons:

- Calls cannot be accessed from an extension phone before The Stick answers.
- Installation requires splitter/adapters (not included) and an extra line cord.
- May need to do a little rewiring at each wall jack.

Most homes and businesses are wired with either 2-pair or 3-pair telephone cable from extension to extension. This installation splitter/adapters utilizes the unused pair of wires in the cable to connect all phones to the VOICE 1 port.

1. The point of connection to the telephone line for The Stick can any extension wall jack. Unplug anything connected to this wall jack and plug a splitter/adaptor into the wall jack.
2. Plug one end of the supplied line cord into the port labeled "LINE" on The Stick and the other end in the "Line 1" port of the splitter/adaptor.
3. Connect the "VOICE 1" port of The Stick to the "Line 2" side of the splitter/adaptor using an additional line cord (not supplied).
4. At extension wall jacks located away from The Stick, unplug any phones from these jacks. Plug splitter/adapters in all wall jacks. Reconnect phones to the "Line 2" side of the splitter/adapters.

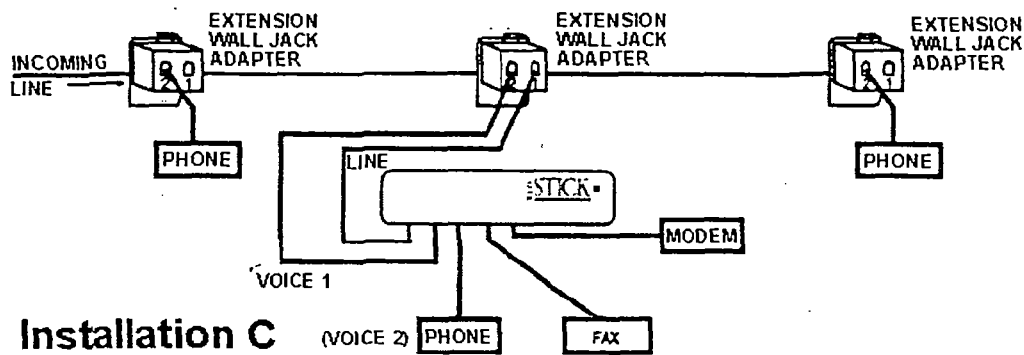
At any point "down line" from The Stick where it is impractical to insert a splitter/adaptor (for example: a wall mount telephone), this type of jack may be converted by:

- a. Swapping the GREEN wire with the BLACK wire
- b. Swapping the RED wire with the YELLOW wire

The phone can then be plugged into the converted jack.

Feature Recommendations Pertinent To Installation

- Set Rings To Answer to "0".
- If you are using Pulse dial phones at any point in installation, set Pulse Detection "ON".



NOT-SO-SIMPLE IN LINE INSTALLATION

Pros:

- Total Barge-In Protection!

Cons:

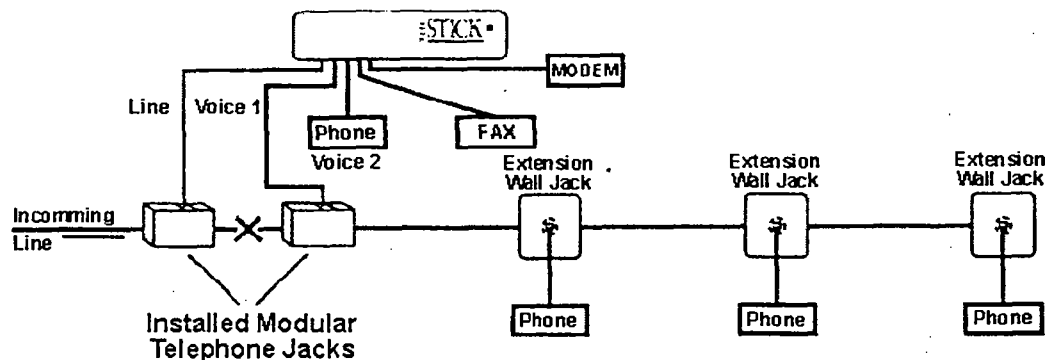
- You may require the services of a telephone installation guru (standard fee-between \$35 and \$70 an hour). Requires severing the phone line before all existing wall jacks and installing either modular jacks or RJ-11 modular plugs and an extra modular line cord.

This one can be real difficult due to the materials required and the point of installation for The Stick. Remember, what we are trying to achieve in this scenario is "Barge-In Protection" all voice calls are routed to all phones and fax and modem calls go to their respective devices-without one being able to access the other.

1. Find a point on the incoming phone line before all wall jacks or telephone equipment. Sever the phone line.
2. Install two modular wall jacks on each end of the severed phone line. Make sure you are using the correct pair of wires when connecting the severed phone line to the modular jacks.
3. Plug one end of the supplied line cord into the port labeled "LINE" on The Stick and the other end into the first modular wall jack. An additional line cord will be needed to connect the port labeled "VOICE 1" to the second modular wall jack.
4. From this location, additional wiring may need to be run to your fax machine and computer modem (if located in another room).

Feature Recommendations Pertinent To Installation

- Set Rings To Answer to "0"
- *If you are using Pulse dial phones at any point, set Pulse Detection to ON.



On Multiple Phone Line System

INSTALLING THE STICK ON A MULTIPLE PHONE LINE SYSTEM

The Stick can be installed in a multiple line application where either an electronic phone system (KSU or PBX) or a 2-line phone configuration exists. Installing The Stick in these types of situations is a little bit more involved than the single line installations previously outlined. Review this section and if things get a little too hairy...call a telephone installer, show him this section and save yourself a lot of time and hassle.

INSTALLING ON A KEY SYSTEM OR PBX

Pros:

- Great Barge-In Protection!

Cons:

- Installation is not for amateurs. Requires you to run station wiring from The Stick to the fax machine and computer modem location.

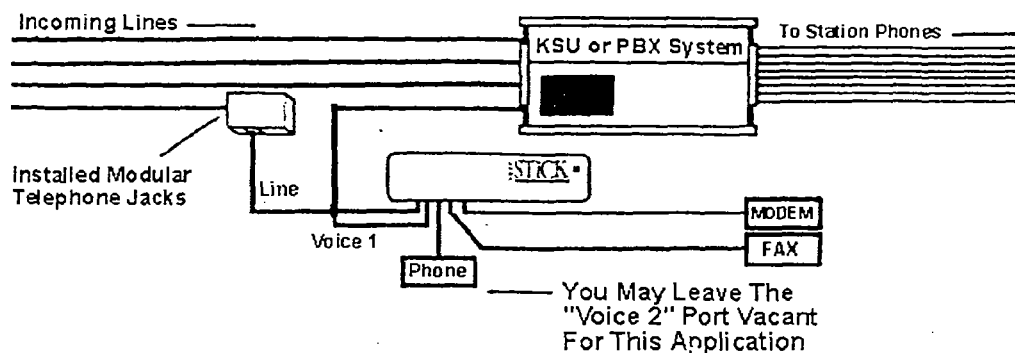
Installation of The Stick on a multi-line phone system should always occur at the "Trunk" side. "Trunk" is telephone nerd-speak for the side closest to the telephone company where incoming lines connect to the phone system. Confused... just look at the picture.

We recommend that if you have rollover from your phone company, install The Stick on the last line of the rollover sequence.

1. Unplug the chosen line from your KSU or PBX. A modular wall jack will need to be installed on that line close to the KSU or PBX if the plug is not RJ-11 modular. If the plug is RJ-11 modular, then it can be plugged directly into the "LINE" port of The Stick.
2. If a modular wall jack is installed, plug one end of the supplied line cord into the modular wall jack and plug the other end into the port labeled "LINE". An additional line cord will be needed for connection from the "VOICE 1" port to the KSU/PBX. From this point phone wire is run to the fax machine and modem.

Feature Recommendations Pertinent To This Installation

- Set Rings To Answer to "0"
- Set Protected Hook Flash to ON.
- If Pulse dial phones are used, set Pulse Detection to ON.



RJ-14 TWO LINE SYSTEM (NO KSU)

Pros:

- Great Barge-In Protection For One Line

Cons:

- This installation is not recommended for even the gutsiest do-it-yourselfer!

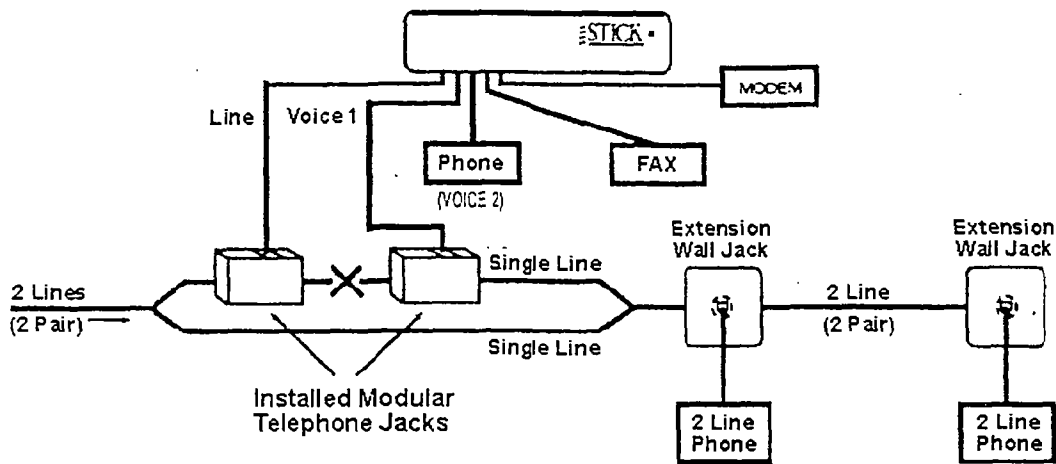
The standard RJ-14 two-line phone system utilizes "two pair" phone line. To install The Stick in this scenario, you will have to access the pair that connection to the line.

This can get really involved. Standard color pairings for telephone wiring are Red with Green, Black with Yellow and Blue with White. To physically see what pairs coincide with each phone number, you may need to chase the wiring back to the "demarcation" point (where Telco wiring ends and residence wiring begins). Before you undertake such a sincere and monumental task, consider this . . .

This wiring scheme has been the Waterloo of many an armchair telephone dude (or dudette). Either you or the wiring is going to win and odds are not in your favor. We strongly recommend- no, we beg of you- call a telephone installer for this one. Show your installer the picture on page 26 of the hard cover manual and/or ask him if he's got a better idea. He might.

Feature Recommendations Pertinent To Installation

- Set Rings To Answer to "0".
- Most two-line phones are not pulse dial, but if you happen to own the only pulse dial two-line phone system in America, set Pulse Detect ON.



Mounting The Stick

The Stick can operate just about anywhere. Here are a few suggestions:

- Mounted to a baseboard at the bottom of a wall,
- On a desk top beside your fax, phone or PC modem or
- Tucked away underneath a desk.

Sticken' It To The Wall

We suggest using an adhesive double-sided mounting tape to keep The Stick firmly attached to any surface. Keep in mind that the adhesive on the tape can be very strong. We recommend that you invest some thought into the best location before peeling back the cover and "going for it".

Sticken' It On A Desktop

Anti-skid material works great to keep The Stick on a desk or counter top and off of the floor. We recommend this for people who might need to relocate The Stick at some time in the future.

Technical Specifications

INPUT POWER REQUIREMENTS-

At AC Transformer: 110-125 Volts AC Only, 50-60 Hz

At Power Jack On Stick: 12-14 Volts AC and DC

POWER CONSUMPTION- 6.2 Watts

CO INTERFACE-

Ringer Equivalence Number: 0.5 B

Input Ring Detection: 40-150 Volts AC, 15-68 Hz

DEVICE INTERFACE-

Battery: 48 Volts Nominal DC To All Devices

Off-Hook Detection: 3-80 mA

Ring Generator Frequency:

30 Hz (+/- .1) Hz Voltage Regulated and Current Limited

Waveform: True Sinusoidal

Ringling:

No Load: Approx. 82.8 Volts RMS AC

8000 Ohm Impedance (REN 1.0): Approx. 81.6 Volts RMS AC

4000 Ohm Impedance (REN 2.0): Approx. 73.0 Volts RMS AC

2667 Ohm Impedance (REN 3.0): Approx. 64.5 Volts RMS AC

2000 Ohm Impedance (REN 4.0): Approx. 55.0 Volts RMS AC

1800 Ohm Impedance (REN 5.0): Approx. 49.5 Volts RMS AC

FCC Registration

This equipment complies with Part 68 of the FCC rules. On the bottom of this equipment is a label that contains, among other information, the FCC Registration Number and Ringer Equivalence Number (REN) for this equipment. You must, upon request, provide this information to your telephone company.

The REN is used to determine the quantity of devices you may connect to the telephone line and still have all those devices ring when your telephone number is called. In most, but not all areas, the sum of the RENs of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices you may connect to your line, as determined by the REN, you should contact your local telephone company to determine the maximum REN for your calling area.

If your telephone equipment causes harm to the telephone network, the telephone company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice is not practical, you will be notified as soon as possible. You will be informed of your right to file a complaint with the FCC.

Your telephone company may make changes in its facilities, equipment, operations or procedures that could affect the proper functioning of your equipment. If they do, you will be notified in advance to give you an opportunity to maintain uninterrupted telephone service.

If you experience trouble with The Stick, please contact your retailer or Multi-Link, Inc., for information on obtaining service and repairs. The telephone company may ask that you disconnect this equipment from the network until the problem has been corrected or until you are sure that the equipment is not malfunctioning.

This equipment may not be used on coin service provided by the telephone company, and is not intended for use with a party line service. This equipment is intended for use only on loop start service, and will not operate on a ground start central office line.

Doc Registration

DOC REGISTRATION

The Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction. Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an accepted method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure, for their own protection, that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop, which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all devices does not exceed 100.

Notice: This product has been tested and meets the Class B limits for radio noise emissions set out by the Radio Interference Regulations of the Canadian Department Of Communications.

Warranty Information

To register your purchase, please fill out the warranty card and mail it.

We warrant that if The Stick Voice/Fax/Modem Call Processor, manufactured by Multi-Link, Inc. and purchased by you, proves to be defective in material or workmanship, we will provide without charge, for a period of one year (USA only), the labor and parts necessary to remedy any such defect. Warranty commences on the date of purchase by the original retail consumer.

The duration of any implied warranty of merchantability, fitness for a particular purpose, or otherwise, on this product shall be limited to the duration of the applicable express warranty set forth above. In no event shall we be liable for any loss, inconvenience or damage whether direct, incidental, consequential or otherwise resulting from breach of any express or implied warranty, of merchantability, fitness for a particular purpose, or otherwise with respect to this product, except as set forth herein.

Some states do not allow limitations on how long an implied warranty lasts and some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

To obtain service under this warranty, you must first request a RMA number from our technical support department. Present The Stick product with the RMA number and copy of a sales receipt (or credit card receipt) or other satisfactory proof of the date of the original retail purchase of the product to Multi-Link, Inc. or an authorized service repair center.

The AC power supply used with this product is covered under this warranty. This warranty does not cover damage, which results from accident, misuse, abuse, improper line voltage, lightning strike, fire, flood, or damage resulting from unauthorized repairs or alterations performed by an unauthorized service center. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

Service Information

SERVICE INFORMATION FOR THE U.S. AND CANADA

Your machine has been registered with the Federal Communications Commission, and under this program, in the event of equipment malfunction, all repairs will be performed by Multi-Link, Inc. or a repair center we have authorized. The owner is restricted from performing any maintenance operation other than those specified within this instruction manual.

If you require service, please contact Multi-Link, Incorporated at:

In Canada:

Unit A1, 6120 - 2nd Street S.E.
Calgary, AB T2H 2L8
1-403-258-1646

In The US:

225 Industry Parkway
Nicholasville, Kentucky 40356
1-800-535-4651

SERVICE INFORMATION OUTSIDE THE U.S. AND CANADA

For units installed outside the U.S. and Canada, please contact your original point of purchase dealer for information regarding warranty and service.

For more information and technical support visit our website at
<http://faxswitch.com>

How to Buy Your Stick

Purchasing Information

Multi-Link products can be purchased securely online from:
faxswitch.com

Or by phone at (217) 337 -0965
Toll Free at (866) 337-0965 within US and Canada.

We look forward to serving you now and in the future.

Thank you.



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You are the current high bidder

Current bid price: \$26.22

Your maximum bid: \$30.00

Important Notice: Rules for bid retractions have changed. [Learn more.](#)

Can you still be outbid?

Yes - although you are currently the high bidder, this does not guarantee you will win this auction. Another user may outbid you, so check back before the auction ends or allow eBay to bid on your behalf. [How does Proxy bidding work?](#)

Other related items from the same seller:



AT&T PARTNER
200E MODULE R3.1

Bid Price \$10.49



AT&T PARTNER
PLUS PROCESSOR
MODULE R4.1

Bid Price \$36.00



LUCENT PARTNER
206E MODULE R4.1

Bid Price \$54.51

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You can keep track of your bids by looking at your My eBay '[Bidding/Watching](#)' page. This is a convenient at-a-glance buying/selling activity page accessible only by you. Try it now! It's free.

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We will automatically send you an email when you are outbid or when the auction ends based on your notification preferences. You can [click here](#) to customize your notification preferences.

What happens after the auction ends?

When the auction ends, eBay will notify the seller and high bidder by email. Both parties then have three (3) business days to contact each other to arrange payment and delivery.

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<http://cgi.ebay.com/aw-cgi/eBayISAPI.dll>

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Lucent Merlin Legend 008 OPT WITH RING GEN (3409839601)

[Electronics & Computers:Networking & Telecom:Telecom:Other:Parts, Components](#)



Current bid **\$26.22**

Quantity **1**

Time left **1 hours, 44 mins +**

Starting bid **\$19.99**

of bids **3** [Bid history](#)

Location **El Paso, TX**

Country/Region**USA/Dallas-Fort Worth**

[Mail this auction to a friend](#)

[Watch this item](#)



Started **Mar-28-03 07:14:07 PST**

Ends **Apr-04-03 07:14:07 PST**

Seller (rating) **abcarreon (7)**

[View seller's feedback](#) | [view seller's other items](#) | [ask seller a question](#)

High bidder **ifixmandhow (2)**

Payment **PayPal, or Visa/MasterCard .**

Shipping **Buyer pays for all shipping costs. Seller ships internationally (worldwide).**

PayPal: Fast, easy, secure payment. [Learn More.](#)



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